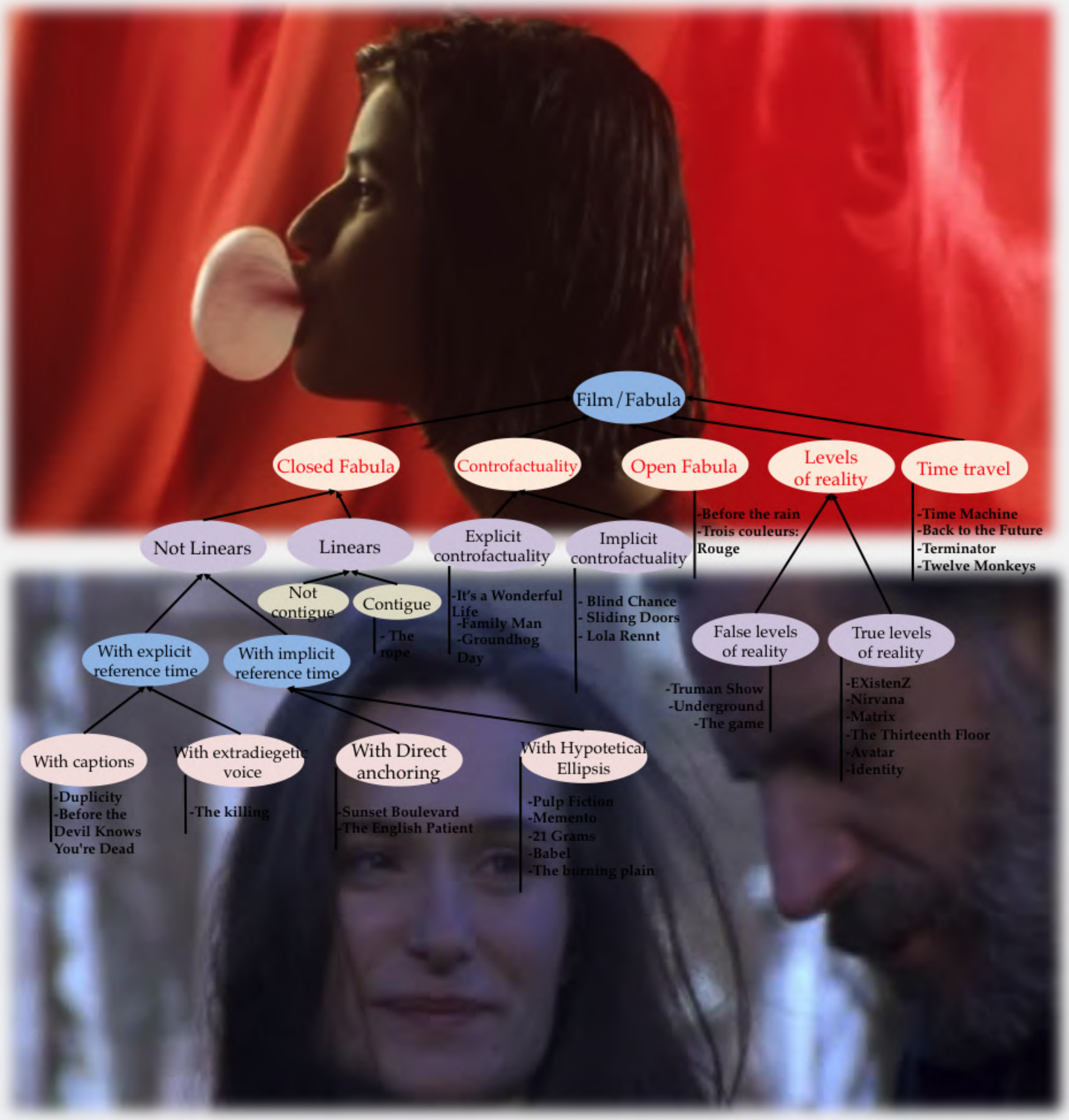
FRANCESCO MELE

Cognitive Models for Films Stories
An Artificial Intelligence Approach



IL Sileno Edizioni

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An Artificial Intelligence Approach

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Abstract

In this book I proposed a methodology to build models for understanding film stories, focusing my attention mainly on aspects of the viewer's temporal reasoning while watching a film. The work has been developed by adopting a cognitive approach through the examination of the acquisition mechanisms and review of the same viewer's beliefs, about the events of a film story. Through this representation I proposed various models of reasoning having the objective of formulating a computational model for the construction of the fabula. The main mechanisms of cinematographic narration (ellipse, flashback, flashforward, suspense, surprise...) are represented in this book as inferential rules using formal axiomatizations of the research area of Artificial Intelligence. I also provided a measure of the degree of story fragmentation, which can be considered as the cognitive cost of a generic viewer, for the understanding of the story itself. The puzzle films, the counterfactual stories, those related to time travels and levels of reality constituted the analytical material that inspired the proposed models. Although my attention has been given to the temporal aspects, and to the main cognitive mechanisms used by the spectator for building the fabula, I believe that the proposed methods may constitute a methodology for the construction of more complex cognitive models of cinematographic relevance, regarding the identification, the expectations and other type of spectator's emotions.

Keywords
Film Theory, Cognitive Models, Artificial Intelligence, Puzzle Film, Temporal Structures of stories.

To Marinella

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PREFACE

This book is the result of my studies on temporal reasoning, as part of my research activities at the National Research Council - for a long time I was involved in the representation of stories and it was only natural that film stories should take up all my attention and become the inspiration for shaping the viewer's reasoning. The spark went off one evening after watching Mirko Manchevski's film Before of Rain - there have been many films in my life that have influenced me - but this was the fatal one for my research. I spent the whole night thinking about what rules of inference an ordinary viewer might have used to anchor the events on the time axis of the story, i.e. what cooperative movements he might have made to construct the fabula. That night I thought a lot, I made many hypotheses, but I could not come up with a minimal theoretical formulation to capture the temporal structure of the film. It became clear to me much later that even though I had identified most of the causal and temporal inferences in the story, the viewer would never be able to construct the story in a linear, temporal way - because the story in Before of Rain contained contradictions: after some episodes in the story the viewer inferred a temporal order for some events and after other episodes inferred a completely different order between the same events. Starting from the analysis of Manchevski's film I began to look for general rules of cognitive order that could be used for the analysis of other films independently of the complex plot that could be presented. In order to represent the mental states of the spectator I worked on my research using modelling techniques typical of Artificial Intelligence. After building a first core of methodology based on this approach I started a long didactic experimentation as a teacher of Semiology of Cinema at the Conservatory of Salerno in the department of Performing Arts Management, for about 14 years I taught in that University Institute receiving a huge critical contribution from the students. Almost all my efforts as a researcher and as a teacher, regarding the cognitive models of the spectator of a film, have therefore flowed into this book. In the words of E. Branigan, this book has been a very long journey. Will it be worth a little or a lot, I don't know. It is not for me to say, but it was the book on which I put most of my energy as a teacher and researcher.

Acknowledgements. The list of acknowledgements is very long, but it is necessary. I omit all academic titles. Leonardo Lesmo (Leo) is the first on the list. I owe Leo a debt that I will not be able to repay - he is no longer with us - but it comes back to me every time I come across particular passages in this book. Leo read my first long report that I wrote on these subjects. With the competence, intelligence and sympathy that everyone knows, he gave me a great many suggestions. I have benefited from his encouragement for many years, I am sure he looks down on me from where he is now - thank you Leo. I owe sincere thanks to Oliviero Stock for the friendly encouragement he has always given me in this quest. A special thanks goes to Cristiano Castelfranchi. He doesn't know it, but for me he has been a great point of reference, a teacher for many of the topics of this book, especially for the approach with which he conducted his research in Cognitive Science and Artificial Intelligence, which inspired me. I remember the emails and chats I had with Cristiano right at the beginning of this research, they were really enlightening for me. A special thanks goes to Giovanni Semeraro for suggesting that I write the book in English, he argued the importance of an international readership for this book. A huge thank you goes to Antonio Sorgente (Nino). My student, then my colleague and then my teacher. For him I use the well-known phrase 'without him this book would have had no light'. In his case, his contribution was truly fundamental. Nino patiently read an earlier version of the manuscript in its entirety, expertly highlighting many 'unclear points', omissions and inconsistencies. Thank you with all my heart Nino. Along with the latter, I must emphasise the contribution of two other CNR colleagues - Gianluca Coda and Paolo Vanacore. I have shamelessly taken advantage of their countless IT skills. They are also the performers of the valuable fragmentation measurements of some film stories, which I have included in an appendix to this book. To Paolo Pulcrano, my lifelong friend, goes all my gratitude for having read several chapters of an earlier version, making very useful comments. I thank Paolo for having believed, together with Giuliana, his wife and my friend, in the completion of this book - even when I myself was showing signs of wanting to give up. I cannot forget the contribution of Giovanni Minei who, at the beginning of my passion for films, suggested articles and books of great relevance to the studies I was carrying out. I wish Giammarco his son (of whom I am an unworthy godfather and who has a great passion for films) and I hope he will benefit from reading this book. I was indebted to Antonio Origlia for the long discussions especially on the long journeys we made to get to some conferences. Antonio has always made constructive criticism of my approach. Although there have been many issues where we have disagreed - thank you Antonio. I have the duty to thank some colleagues who directly and indirectly contributed to the publication of this book: Antonio Calabrese, Massino De Gregorio and the maestro (he knows why I call him that) Vito di Maio. I would like to thank Francesco De Pascale for the esteem and enthusiasm he has shown me in giving birth to this book and Ambra Benvenuto for her expertise and patience with me on the editorial aspects. A final thank you (but it is the first on the list) goes to my life partner Marinella, for her affection and above all for sharing the worries and discouragements that arose during the course of this demanding writing project - I have dedicated this book to her.

Acknowledgements for English supervision. Many thanks go to Maria Rita Caparrotti. In an early version of the book manuscript, she systematically and competently supervised the writing of the English. Maria Rita's contribution was not only about the English language but she also made an important contribution with observations and suggestions that went beyond her task as an expert in the English language. Again, thank you very much Maria Rita. The many updates and revisions to the first version of the manuscript necessitated subsequent English supervision. I received support from my colleague Massimo De Gregorio who advised me on the introductory and concluding parts of the book. While Antonio Calabrese contributed to the translation of a paragraph of chapter 8. Finally, I owe a great debt (again) to Antonio Sorgente who carried out an English writing check of the entire final version of the manuscript.

In any case, all possible grammatical and semantic errors in the English are to be attributed to the author of the present book.

INTRODUCTION

In contemporary cinematography there is a rising movie production presenting stories of difficult reading and interpretation. These movies ask the spectator a high use of cognitive resources, both in space of memory, and inferential abilities, in particular in the mental processes activated for the construction of the fabula. To these movies have been associated some labels[1] such as movie with ”complex plot”, ”complex narrative”, ”modular narrative”, ”puzzle film”, ”forking-path films” and so on. These movies belong to species, created in an evolutionary process, that have roots in the movies in which the first flashbacks and flashforwards in the history of the cinema, were presented. To my knowledge, the film that presented the first story with a complex plot was "The Killing" by S. Kubrick - in which the story is presented by the frantic movement of the hands on the axis of the story. Although in S. Kubrick's movie explicit indication of the temporal jumps of the story are given (an extradiegetic voice at the beginning of every episode), with the aim of reconstructing the fabula the spectator is obliged to make complex temporal anchoring. Along the way began by S. Kubrick, an exemplar historic turning point has been given by *Pulp Fiction*[2] by Q. Tarantino, in which the plot complexity grows because of many temporal jumps in the story, not explicitly enunciated in the filmic text. Recently, with the same typology of

1 W. Buckland has opened a wide philosophic debate regarding the label ”Puzzle Films” – in some of his books [Buckland2009], [Buckland2014] and collects a series of articles of cinema researchers in which are present reflexions and analysis of movies having a complex narrative structure. The term *modular narrative* has been introduced by A. Cameron in [Cameron2008], while the one in ”Mind-Game Film” by T. Elsaessere (see always [Buckland2009] pp. 13-41). ”Multiple-draft” narrative, in the end is the term adopted by E. Branigan [Branigan2002] to denote that the complex form or telling, are entities asking for multiple interpretations, that can be explained through elements of theory common to all the stories. In brief E. Branigan affirms that all stories are complex and that is superfluous – to adopt the term ”Forking-path” (suggested by D. Bordwell) to denote a special category of stories asking for a particular theoretical apparatus for their explanation. A discussion in this interesting debate is given in [Simons2008].

2 [PulpFiction]

narrative structure, *Memento* by C. Nolan and *21 Grams* by A. Gonzalez Iñárritu, have been proposed – movies having the characteristic of really testing the spectator's cognitive abilities in reconstructing the causal and temporal connections of the story events. The movies above mentioned, have put in discussion many existent theories, although in my opinion, for the analysis of the film, the cognitive approach is a very promising theoretical framework. In this approach, the spectator and his mind have been put in the middle of the theory, and the whole analytical effort has moved towards the effects that the movie provokes in the spectator. Notwithstanding the great number of analysis of complex movies executed, only partial theories have been produced to explain the complex plots. This has also emerged from the dispute of some famous cinema's theorists. E. Branigan answering to D. Bordwell, sustains that movies presenting forking-path phenomena "are just a special, limiting case of a more general phenomenon underlying all narratives" – which is the general phenomenon, he does not say it. E. Branigan emphasizes only on the fact that hypothetical theories given lack in some basic dowels for a unifying theory of the movie – obviously he gives an implicit challenge to search them.

It is at this point that the contribute of this book is inserted. In this work I support the motivations of E. Branigan and I add that – actually there is not a formulation of an unitarian theory. What proposed at moment is, in almost all analysis of a movie[3], is a body of conjectures hardly applicable in the different analysis of movies. This is due to the fact that there is a lack in models – above all models providing an explanation – at a theoretical level a movie has to answer to the question of excellence "why does the spectator understand a movie"?

What is missing to the analysis of the movie with a cognitive approach, is a clear epistemological frame of how a theory has to be formulated, to answer to this question. Often in many theoretical formulations the analysis confounds two aspects "the one to have understood the movie" and "the one to have given an explanation about why we have understood the movie". To observe a flying airplane, to follow it with the glance in the sky, to individuate that it is the fly of an airplane not of a bird for example, doesn't presuppose we understand the theory of flight.

3 I mention in particular the comments of analysis about movies from different authors reported in [Buckland2009] and [Buckland2014]

The emotion that a movie's vision gives us, together with the fact that the movie has been understood – easy or difficult whatever it is – hasn't to allow us to affirm that such perception is a synonymous of having normative rules, in other words that the recognizing of the phenomenon coincides with the possessing the theory.

If the comprehension of the movie by the spectator is a phenomenon that has to be explained, then it should be done through a specific methodological statute (even if not quite complete) in which we need to show in a rigorous and formal way, starting by the filmic segments observed, as change the cognitive states in the spectator. If we do not adopt this statute – we can only provide some clever comments or even brilliant insights without providing any explanations of the phenomenon. Below these lines there is the conviction that some key notions have not been fully used in the analysis of the movies concerning the mental causation. If cognitive theorists have chosen the mind of the spectator as the principal object of survey and the explanation as a paradigm of what is understood in a movie, then we need a representation of mind based on an adequate concept to this purpose: spectator's cognitive state. We need then, through a causal pathway, explain how such states change over time. It is obvious that every cognitive change must be justified by cognitive causal rules. In this scenario, the explanation is simply showing the chain of cognitive inferences that the viewer has applied in all the changes of his cognitive state. The one just presented is one basic presupposition to build a movie theory cognitive oriented.

I believe anyway, that the validation of the theory is a separated question by the proposition of the theory. As separated by the methodology, to establish who is the reference spectator in the analysis proposed for a movie – or if different cognitive rules exist (different spectator models) which bring to different explanations for a same filmic text – I believe these are questions regarding the refinement of the model and not about the methodological approach used.

The actual theoretical cinema production sees the object movie as a phenomenological level, with the statute ”it happens X” – without showing casual rules, or ”it happens X because of Y and for the existence of a rule L”. Regarding the methodological approach of this book my intention is to show that every entity X presented in a movie, has always to be put in correspondence with the creation of a *mental event* in the spectator, activated by a perceptive act A and by a cognitive rule R in his possession for the update or revision of his mental state. The supposed spectator's cognitive capacities A and R, must have obviously validity and plausibility; they have the role to justify the mental phenomenon when it happens and foretell others not yet happened (in the same movie and in future movies) – this has to be actuated with a methodology the nearest to the one proposed by physics for the explanation of a natural phenomenon.

I believe that the cognitive oriented theorists in the cinema, in putting spectator's mind in the middle of the analysis of the movie, have seen right about which is the entity to take into account – I fully share this choice. This constitute according to us only the beginning of a complex research program, being the mind not a physical system in which you can execute physical measures, but an entity that can be studied only through models – the problem is transferred so on the choices of how to represent it.

I believe that the sector that can give an answer to the necessities of representation of spectator's cognitive states just reported, is the one of the Artificial Intelligence that for more than 50 years has studied representation models of the mind. These declarations of the survey method constitute the prerequisite for an exhortation – convinced and motivated – to adopt new tools in order to provide more efficacious methods for the film analysis.

CONTENTS AND BOOK ORGANIZATION. In the chapter 1, I deal with how the techniques of knowledge representation proposed in Artificial Intelligence are adequate to build spectator's mental model in cinematographic context.

I argue how the beliefs – as mental attitudes – are the most suitable representation to model the cognitive change in the spectator when observing filmic events, these when appearing in the telling, trigger processes to build beliefs on the story events, and on the temporal relation among them. My proposal have as starting point the *Speech Acts Theory* proposed initially in Philosophy of language and rewritten by J. Allen in terms of mental attitudes of the speaker and of the interlocutor. In this chapter I propose a comprehension theory of the film, through the spectator's beliefs representing the effects of the perlocutionary acts, this latter caused by the film vision. In this way the vision of a movie is a ”cognitive affair”. The explanation of the comprehension of the movie is represented by cognitive states connected through causal relations.

In chapter 2 I propose a representation based on beliefs having as argument one event (or more events) of the story. Each events is represented through the happening diegetic interval; what happens in the event; the participants to the event (humans and physical), where the event happens and why. In the representation there are two kinds of causality – a causality that puts in relation two spectator's mental state and a causality (spectator's beliefs) about the story events. In this chapter I propose a principle of beliefs acquisition (in analogy to what happens for the linguistic acts) – in this way the events proposed on the screen, represent a communicative act generating beliefs in the spectator, persisting until new story events suggest to remove the acquired beliefs. In the model of the spectator's mind I have taken into account also beliefs, intentions, and desires of the characters. In this chapter I introduce a tool – the diagrams TN-TS-TB – representing the time of filmic sequences presentation on the axis TN (Time of the Narration); the diegetic time of the events believed happening by the spectator, on the axis TS (Time of the Story); and the validity time of the spectator's beliefs, on the axis TB (Time of Beliefs).

In chapter 3 I introduce a cognitive model in which are represented the relation between time of narration (TN) and time of Story (TS), and where in correspondence to the narration time TN, spectator's beliefs are represented (the axis of mental time (TB)). In this model the time of narration is chronological – and coincides with the spectator's vision time – in contrast to what happens to the literary text, whose time (reading time of the text) either does not exist, or is a pseudo time (it can be considered only in a fictitious way). Through the diagrams TN-TS-TB I represent and reformulate the basic narrative figures, such as scenes, pauses, slowing down, expansions and ellipsis, in cognitive terms. I analyze in a detailed manner the articulation of the scenes, by classifying them according to the relation of the events with space and by presenting some basic temporal inferences possessed by the spectator. I show that the time perceived by the spectator has an own cognitive autonomy duration, independently of the chronological time of narration and of eventual clocks inside the diegesis. For the ellipsis I define and formalize a cognitive state of the expectation generated in the spectator when there is the interruption of the story, and I introduce some example of inferences that permit us to connect in the temporal axis the restarting point of the story, after that an ellipsis occurred.

The chapter 4 is devoted to flashbacks and flashforwards. A preliminary discussion regarding the choice of the base categories for the temporal analysis of the movie stories is reported. In this chapter I argue that it exists a lack, in taxonomic terms, of the narration figures (analepsis, flashback, ellipsis, and so on) also underlined by famous cinema theorists. I report a formal analysis of the candidate figure categories, to be inserted in one taxonomy, separating the interruption figures and ones of fitting. It emerges a new classification, in which it is introduced a new figure – the temporal deixis for evocation – often activated by the spectator to connect events on the axis of the story. I also propose a new model of flashback having a strictly cognitive formulation, that refines the Branigan's model[4]. In this chapter are taken into account some movies where explicit time is used, to give the spectator indications of temporal jumps in the story, through captions, clocks and extradiegetic voices. For the analysis of this narrative forms, I propose a new formalization of Reichenbach's tern that permits us to formulate spectator's cognitive rules among the time of the happening and the time of reference enunciated through extradiegetic voices, captions, diegetic clocks, and so on, shown in the story.

In chapter 5 as inferential rules I introduce the temporal deixis adopted by the spectator to connect the events on the temporal axis of the story. The chapter opens with a reformulation, in cognitive terms, of frequency concept introduced by G. Genette [Genette1986]. I report in formal way, some recognition rules concerning the events repetition in the story.

In chapter 6 I discuss about cognitive states of characters in the stories that is on the beliefs that the spectator has about the intention, the desires (the objectives) and the beliefs of the characters. Such states have been classified through the way they arise in the spectator, that is through the telling of others characters, the remember and the dream and in particular through the modalities in which the characters *see* the events – the ocularization. A taxonomy of the ocularization and a cognitive notion of focalization in terms of beliefs of the spectator on characters' beliefs is proposed. Furthermore I formulate the focalization regimes defined in terms of relations among spectator's beliefs

4 see [Branigan1992]

acquired through the mediation of a character and the ones without mediation. In closing this chapter I describe a particular focalization – the flashback within a flashback – present in some narrative of films.

In chapter 7, from a cognitive point of view, the temporal structure of the stories are presented. I hypothesize that the cognitive state activated by the spectator constitutes the basic component to characterize a story. Moreover I introduce a basic element of analysis for the structure of stories: the macro event. In paragraph 7.4, I formulate a measure for the story fragmentation based on: the density of discontinuity (a discontinuity is created every time a story is interrupted); the density of the hypothetic ellipsis; and the density of the wideness of inference. The latter is calculated taking in account the distance on the axis of the narration, between the enunciation time of the current event and the enunciation time of the event evoked by the deixis.

The fragmentation degree of the story, for how they are formulated, constitute a kind of cognitive effort that the spectator has to put to construct the fabula. In this same chapter two notions are introduced: the one of the fabula consistent and the one of inconsistent.

In chapter 8, always in a cognitive terms, three typologies of stories are represented: the counterfactual stories, the stories presenting time travels and ones with levels of reality. For this narrative forms, I introduce a formal definition for the course of events. Such entities are formally characterized by the condition that inside of them there are not inconsistencies, and exist specific modalities of access to them – furthermore some compatibility rules among courses of events can also exist.

The proposed model takes as point of starting, the Multi-Context Theory [Ghidini2001], developed by a group of researcher of FBK Institute (Trento, IT). I represent every course of events through one context in which there aren't inconsistencies.

For every of story above cited, I have built a model based on the context notion.

In the appendix 10 I report a representation of spectator's inferential activities for the movie *Pulp Fiction* using the formalization introduced in the chapters of book.

In the appendix 11 I present an methodology to annotate stories of films, and in particular I report the complete annotations related to three movies: *Pulp Fiction*, *Memento* and *The English Patient*. Using these annotations, I have adopted the measure of fragmentation, introduced in chapter 7, to compare, from a structural point of view, the three films.

I propose in this book (in strictly formal terms) an abstract formalism formalized using the Answer Set Programming as formalism, and the axiomatics of the Event Calculus as engine for the spectator's reasoning,

The reason for having initially chose an abstract formalism - lies in the fact that it was my intention to present a wide repertoire of models and reasoning rules, in which some inferences can be immediately rewritten in terms of *Answer Set Programming*, leaving not completely formalized other rules that require an in-depth further work.

It is my belief that a computational model of the viewer's reasoning is a very complex task, of which this book (I hope) might constitute a first step.

Part I

Basic concepts for a cognitive computational theory

1 FOR A MOVIE THEORY WITH COGNITIVE APPROACH

In this chapter, I introduce the reference methodological ambit for the construction of spectator's cognitive models – I have chosen to represent them according to a representational approach of cognition – that is, structured through discrete cognitive spaces, subdivided into occurrences of beliefs (bel), desires (goal) and intentions (int). In this section I argue that knowledge, as basic mental attitude, is inadequate to represent spectator's cognitive change – I address my preferences towards the belief as basic element to represent the mental state.

1.1 INADEQUACY OF KNOWLEDGE

The basic mental attitude to represent the spectator's cognitive state is a problem discussed many times by cinema's theorists. Colin[1] for example assumes that the result of the act of seeing would be a knowledge – according to this supposition "if the spectator sees that X is P", then "he knows that X is P"[2]. In this book, I sustain the inadequacy of knowledge, in the conviction that *seeing doesn't implicate knowing*. I take into examination the scene in *Harold and Maude*[3] – it is a young boy hanging himself (figure 1.1.1a). The spectator sees the young hanged, so (according the approach based on knowledge) he knows that the boy is dead. In a following scene (figure 1.1.1b), it is shown the same young boy laughing (so the young boy is not dead). At this point the spectator is obliged to operate a revision of his knowledge – the young (later we will know his name is Harold) is no longer dead. If after the presentation of the second scene, we could question the spectator what happened, he would affirm something like "I believe he was dead and instead it wasn't

1 Presented in [Colin1988]
2 The sentence is quoted in [Rondolino2011] p. 43
3 [HaroldAndMaude]

(a) Harold hanged himself. **(b)** Harold laughs.

Figure 1.1.1: The false hanging of Harold in *Harold and Mauge*

so". Therefore see doesn't mean to know (rather believe) – the knowledge is so not adequate (at least terminologically) to the cognitive change in the spectator. To argue these statements, I introduce a less qualitative notion of knowledge, borrowed by the logic[4], defining the knowledge as a belief supported by truth. According to this definition: a person P knows a thing X (or also, P knows X) if two propositions are valid: the first is that "P believes X", and the second is that "X is true". The first component is subjective, while the second objective. I prove to applicate to the filmic events the knowledge definition given above – by substituting to X "an event happened in the story" and to the person P "the spectator". The definition given above becomes: the spectator P knows that the event X has happened in the story, if P believes that X has happened and it is true that X has happened in the story. In the two scenes analyzed before, the spectator "knows that Harold is dead" if he believes that Harold is dead" and if it is true that Harold is dead". Unfortunately, to the last objective proposition is not ascribable a value of truth, as to record "Harold is dead" as true, we should activate a process ending with the end of the movie (the movie until his last sequence could show, through a flashback for example, Harold alive). After the first scene (a) it is suspended the attribution of truth to the event "Harold is dead". Neither after the second scene (b), after Harold laughs, it is possible to ascribe a truth to the happening of the event – the story could collocate, for example with an appropriate editing,

4 I have adopted the definition by S. Galvan [Galvan1991] in which the knowledge is formulated as right belief: $\mathsf{Sx} \Leftrightarrow \mathsf{Cx} \wedge \mathsf{Vx}$. This means that there are two conditions necessary and sufficient to know X (Sx) – the first is that you believe X (Cx), the second is that X is true (Vx) – so a subjective condition Cx, and another objective condition Vx.

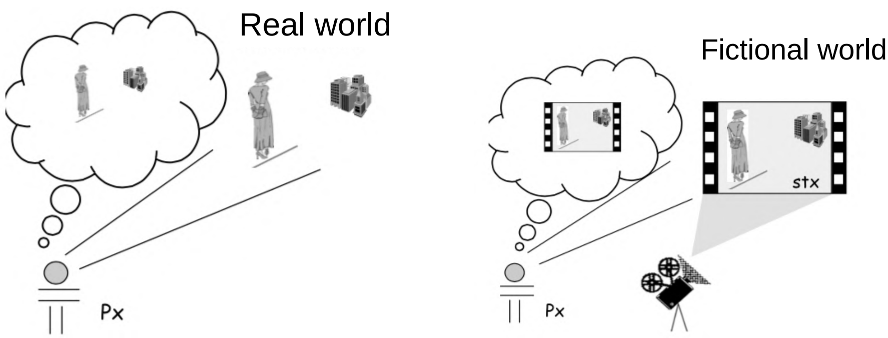
Harold laughing as an event happened before the hanging of the same Harold. The choice of the knowledge, so, does not allow us to attribute beliefs to the spectator – step by step – during the vision of the movie. This would involve the renounce to a necessary requirement of the explanation apparatus that has to be adopted to analyze cognitive phenomena, that is the availability to have a model able to provide an evolution over time of the spectator's mental state.

Definitively, knowledge is inadequate as tool in a theoretical perspective of cognitive analysis of the film. According to the motivation given above, I have chosen the belief[5], as basic attitude as it eliminates the above mentioned problems – it is not a case that theories of beliefs have been developed in Logic and in Artificial Intelligence, just to have available a formalism to represent the cognitive change of a rational agent.

REAL EVENTS AND REPRESENTED EVENTS. I believe that the spectator of a movie (like any other a rational agent) in general owns some cognitive primitives that permit him to distinguish if he has seen, has heard by someone, has dreamed, or has imagined an event. In particular we can hypothesize that the spectator is able to distinguish two typologies of event occurrences: an event happening in reality – in daily life ($\mathsf{real}(\mathsf{Ex})$), and an event happening in a representation – in a film story ($\mathsf{stx}(\mathsf{Ex})$). We consider the case in which an agent Px sees a woman walking in a street (event Ex). Px is capable to distinguish if Ex is an event belonging to the real world or to a fictional world. In this distinction Px takes advantage of the fact that a fictional representation almost always presupposes the existence of a projection and above all of a not real screen(see the figure 1.1.2) – intended as container/delimiter of represented events[6]. Obviously, as are different the contexts

5 Various meanings of beliefs exist – two of them are the ones of implicit and explicit belief. "the implicit belief regards everything believed by a subject. In other terms from the point of view of the implicit belief we take into account «not what an agent directly believes, but what will be the world if what he believes would be true». So, if we believe A, and A implies logically B, then is implicitly believed also B, as it would not be possible a world in which A is true and B is false, ... everything that an epistemic subject believes effectively true (or, we could say, all those beliefs having a potential validation on its behaviour) it is said by Levesque an explicit belief" (the implicit/explicit explanation is by M. Frixione [Frixione1994], while the quoting among angle brackets is by H. Levesque [Levesque1984]).

6 It also takes into account the discussion in the chapter first in [Elsaesser2009] where it has been put, as main reference of the narration protocol, between the spectator and the world of fiction, the concept window-frame



(a) Px sees a woman walking on the street **(b)** Px sees a woman walking on the street in the story

Figure 1.1.2: Events in real and fictional world

in which the stories happen, different should be the beliefs through which Px records in its cognitive space what has observed:

$bel(Spx, belongRw(rwx, Ea))$
% Spx believes that Ea happens in the real world rwx
$bel(Spx, belongSt(stx, Eb))$
% Spx believes that Ea happens in a fictional world stx

Regarding the arguments I dealt with in this book, it is not necessary to represent real and fictional events using specific annotations. I imagine the spectator sitting in the cinema or in his sofa, to eat chips and drink beer – and these real events aren't of interest to the analysis I make on spectator's cognitive states. So, going on in this essay, I won't use the suffix real. When I write $bel(Spx, Ex)$ I intend the belief of the spectator Spx regarding an event Ex happened in a movie story. Notwithstanding, if necessary, I are going to use suffixes for events of the kind $st1$ and $st2$ in $bel(Spx, belongSt(st1, Ea))$, $bel(Spx, belongSt(st2, Eb))$ ... and so on, to represent the spectator's beliefs on events belonging to different partial stories $st1$, $st2$.

KINDS OF BASIC BELIEFS – AN ANTICIPATION OF FORMALISM. In the formalism proposed in this book the beliefs are represented according the time in which they begin to be valid, with the term Tx. I will consider different kinds of beliefs to describe the spectator's cognitive state, and for each of them in this book I will introduce the specific representation. Actually I report the following definitions:

- spectator's beliefs about the events in the story:
  $mev(Tx, bel(Spx, Ex))$ –
  at the time Tx the spectator Spx believes that the event Ex happens in the story.

- spectator's beliefs about story characters' beliefs:
  $mev(Tx, bel(Spx, bel(Px, Ex)))$ –
  at the time Tx the spectator Spx believes that the character Px believes that the event Ex happens.

- spectator's beliefs about story characters' desires (goals):
  $mev(Tx, bel(Spx, goal(Px, Ex)))$ –
  at the time Tx the spectator Spx believes that, the purpose of the story character, is to achieve the goal-event Ex.

- spectator's beliefs about story characters' intentions:
  $mev(Tx, bel(Spx, int(Px, Ex)))$ –
  at the time Tx the spectator Spx believes that, the intention of the story character, is to achieve the goal-event Ex.

- spectator's beliefs on the order of events:
  $mev(Tx, bel(Spx, prec(Ex, Ey)))$ –
  at the time Tx the spectator spx believes that the event Ex precedes the event Ey.
  $mev(Tx, bel(Spx, eq(Ex, Ey)))$ –
  at the time Tx the spectator Spx believes that the event Ex happens in the same interval of the event Ey.

- spectator's beliefs about the causal relationships among events:
  $mev(Tx, bel(Spx, cause(Ex, Ey)))$, (or $mev(Tx, bel(Spx, Ex \Rightarrow_{CE} Ey)))$ –
  at the time Tx the spectator believes that Ex causes Ey.

- spectator's beliefs on the belonging of an event to a partial story (symbol $belongSt$), to a macroevent (symbol $belongMacr$), or to a course of event (symbol $belongCev$), respectively:
  $mev(Tx, bel(Spx, belongSt(stx, Ex)))$, mev(Tx, bel(Spx, belongMacr(mce, Ex))), and, mev(Tx, bel(Spx, belongCev(cvev, Ex))).

1.2 ATTRIBUTIONS OF BELIEFS TO THE SPECTATOR

J. Allen has reformulated the *Speech Act Theory*[7] in terms of mental attitudes (beliefs, intentions and goals) of the participants to a dialogue. In particular, the proposal had to represent the speakers' illocutionary acts as intentions, and listeners' perlocutionary acts as beliefs. In this scenery, the illocutionary act (the speaker's intention) constructs a kind of "force" determining, through the utterance, a variation (update and /or revision) of listener's beliefs.

J. Allen's theory just quoted, is not directly applicable to the filmic text – this for different reasons. The first is that the force determining the variation of the cognitive state goes through a specific communicative protocol, different from that of a linguistic act[8].

According to us, a characterization of the fictional act happens because a spectator watching a movie, *labels* the act of fiction (or of no fiction), starting by metatextual entities, deriving from the communicative context where the interaction happens – the images arrive to the spectator through the screen – he knows that what he is watching is a movie story – maybe it is written in the caption, in the screen or in the movie poster at the entrance of a cinema. The identification in the specific context, in which the communicative act happens, permits the recognition of a fictional communication.

Another major difficulty in applying the theory of speech acts to the film text, is that the author's intentions of the movie can be perceived by the spectator only through many passages – after a process of aggregation and transfor-

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7 The theory of Speech Acts formulated firstly by J. L. Austin [Austin1962] contemplates three main kinds of acts: - Locutionary act: the speaking or writing in a sentence; - Illocutionary act: act of a speaker (or of a writer) in terms of the effect that the author of the act wants to activate in the listener (to persuade, to convince, to intimidate and so on); - Perlocutory act: the effect that the illocutionary act produces on the addressee (feelings, expectations, and so on) as consequence of the comprehension of the locutionary act. The reformulation of the theory of Speech Acts by J. Allen is given in [Allen1983], [Allen1987].

8 In regards the text literary G. Genette [Genette1994] warns that the illocutionary act of fiction is not a serious act:

> It seems that the utterance intentionally fictitious can be reasonably described as not serious assertions (or not literary) hiding, as in the indirect speech act (or of the figure), declaration (or requests) of explicit fiction

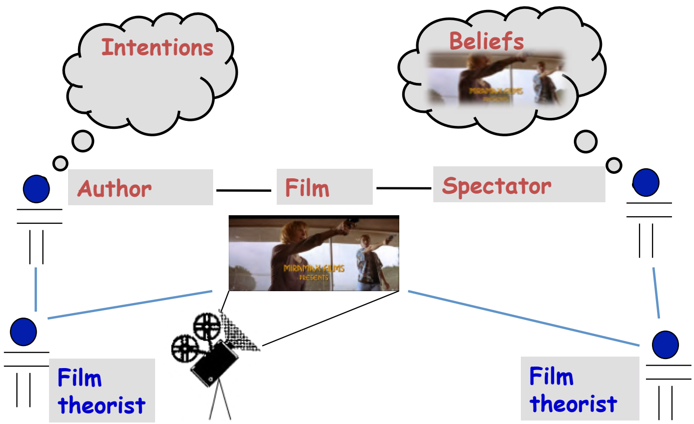


Figure 1.2.1: Author, Film, and Spectator tripartition

mation of intentions belonging to many minds (scriptwriter, director, actors, film editor), in which it is difficult to attribuite an exact responsibility of the fictional illocutionary act. If for example a scriptwriter wants to create in the spectator a particular emotion, in a specific point of the story, the director *reads* in the screenplay this intention, and tries to put it on the stage in the best way by giving instructions to the actors, who take in conside-ration such indications. After having realized the filming, the film editor performs appropriate cuts or extensions to the story and pays attention to the effects. In the process described, many intentional contributions are materialized on the screen in an inseparable manner. In such a way, in a visual act the spectator hardly recognizes author's intentions as resulting from more contributions – the ones of the scriptwriter, director, actor, and so on. The author, so, can't be perceived by the spectator – on the contrary of how happens in a traditional linguistic act, in which it is possible to locate the speaker and associate to that *material entity* an intention – an illocutionary force. According to us, cinema theorists have created many different names (le grand imagier, the invisible narrator, the enunciator, the implicit narrator, the mega-narrator, the foyer)[9] just because the true emissary of the locutionary filmic act is hidden in the long chain of the production of the filmic act.

Although the spectator does not perceive in a fictional act an intention, it does not mean that the author creates the movie and the screenplay without in-

9 All the names present in brackets have been quoted in [Rondolino2011] p. 22

tentions. I believe that it is easy to convince that the movie's author possesses all the mental attitudes of a rational agent: intentions, goals, beliefs.

Indeed, he has goals and pursues them (that is to say he has intentions) – putting aside some (meta) objectives such as the personal success, the movie success, and so on – he has communicative objectives: what to report in the representation, how to express a particular action (and in which way), how to describe a sorrow, a joy (intense or not it doesn't matter), or also how to arouse curiosity in the spectator – a surprise or a suspense. In other words, the author has intentions and *manipulative objectives* (quoting A. Gremais)[10], to bring the spectator to believe that, (in a determined context of fiction) "someone has killed", "someone is guilty", "someone suffers", and so on.

The spectator, instead, does not execute manipulative actions, he is only a receptive subject of the act stated on the screen – he is the executor of a perlocutory act only. In my modelling[11]. (see figure 1.2.1), the spectator's cognitive state, is represented without direct intentions or objectives – but only by beliefs on the story events and on temporal relations among the events. This does not exclude that the spectator can have beliefs on characters' goals, intentions and beliefs (represented as $\mathsf{bel}(\mathsf{Spx}, \mathsf{goal}(\mathsf{Px}, \mathsf{Ex}))$, $\mathsf{bel}(\mathsf{Spx}, \mathsf{int}(\mathsf{Px}, \mathsf{Ex}))$ and $\mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Px}, \mathsf{Ex}))$ respectively). For exam-

10 [Greimas1994]

11 The tripartition I have reported has many tracts in common with the tripartition by Jean Jacques Nattiez, proposed for the musical discourse. He supposes (reported in [**basile2013**]) and develops a semiology of the music, according to a model in which the forms of human expression can be defined and analyzed as symbolic forms – through three dimensions:

1. a process linked to the creation of the work, that is to the sender – the set of strategies thanks to which, in the end of the creative act, it exists an object work that becomes the object of the analysis;
2. a process linked to the perception of the work, that is to the receiver – the set of strategies put in act by the receiver, namely during the perception of the product, this last one object of the analysis;
3. a neutral or material level, the musical object, the work, that can be analyzed as text, that is by the point of view of his inner organization.

J. J. Nattiez believes that also if the process a) is linked to the b) through a complex productive chain of construction both in the form than in the content of the work, the two processes cannot have a correspondence. In other words that the user can interpret the work in a different way from the intention of the author. The thesis by J. J. Nattiez is difficult to contest – my contribution to this thesis is that in the construction of a theory is necessary to take into consideration more than one user of the work, in order to reduce the probability of mismatch (in the sense above reported) ple, the spectator can believe that a specific character Px has the intention to kill another story character Py, in these cases the intention belongs not to the spectator, but to the character Px. I are going to use for these beliefs locution of the kind "the spectator believes that Px has the intention to make the event Ex happen" with the corresponding representation: $\mathtt{bel}(Spx, \mathtt{int}(Px, Ex))$.

Studying and identifying the relations between *Film* and *Spectator*, do it means to give a contribute to construct a theory of movie comprehension – while studying and identifying the relations among *Author* and *Film+Spectator*, do it means to give a contribute for a theory of movie generation[12]. Until this moment, the cognitive theorists have focused their analysis on the spectator, producing mostly theories of movies comprehension and few theories focusing on the relation between author and spectator[13]. I believe that this happened because adequate tools to the analysis of the movie, such as methodologies giving models of representation to analyze the spectator's cognitive state, have not been proposed yet.

In this particular model I propose, I think to an instrument that can be adopted by a Cognitive Theorist (CT) (figure 1.2.2), who attributes beliefs to the spectator Spx, at every presentation step of a narration segment – in such way an attribution of beliefs is a process of CT's annotation occurring through the following path:

1. CT sees the filmic segment $Segx$;
2. CT believes that Spx sees $Segx$;
3. CT believes that Ex happens in the filmic representation $Segx$;

12 A theory dealing with the production of movies, is contained in the book *Story* by R. McKee [McKee2000] – it is a book in which is reported a relevant experience of the author in the production of movies script. The theory of generation proposed in the book *Story*, also if seems to emerge from knowledge about what happened in a wide temporal line in the story of the cinema, is actually an implicit theory of generation deriving from the effects analysis of the cognitive actions that the movie operates on the spectator, and so constructed by what the same R. McKee perceives and attributes to the spectator. In other words, *Story* is a work using an implicit theory of the movie comprehension, to propose then a generation theory.

13 No doubt that these theorists have consciously put in the middle of their analysis the spectator, producing acute theories for the movie comprehension. Notwithstanding, according to us, they have lacked in the awareness to constitute an *external eye*, that is inserted between the spectator and the movie, well distinct by the one of the spectator. In effect it is lacked the awareness to recognize an annotator, that attributes to the spectator both beliefs on the story events and on cognitive rules, to represent as the spectator understands the story

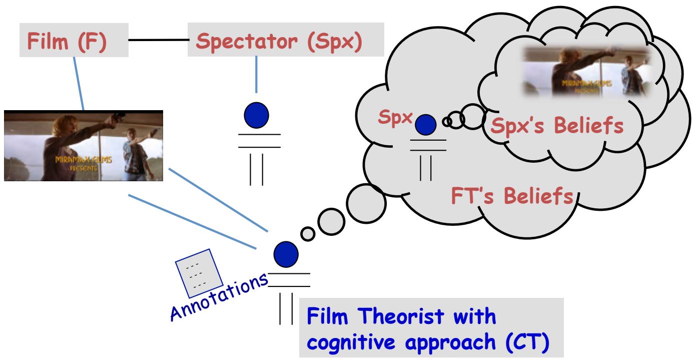


Figure 1.2.2: Attribution of beliefs to the spectator

4. CT believes that Spx believes that the event Ex happens in the movie story;
5. CT believes that Spx has an opportune cognitive rules R_i so to permit Spx to establish that Ex happens in the story.

By adding to the attribution of spectator's beliefs on story events, CT attributes also some abilities of reasoning, hypothesizing that the spectator owns a set of rules R_i, to connect the story events. The process of beliefs attributions on story events, and of inferential capacities to the spectator, is a fascinating and complex process that leads to ask questions such as:

"which is the knowledge or the mechanism that a CT possesses and applies for these attributions?" or also "who assures us that the beliefs and the inferences chosen by CT are the spectator possesses?"

Ie nter here a new analysis level regarding the point of view of *who observes* – of *who* constructs the theory – the question evokes obviously an *infinite process*, because who gives a judgement on who observes is he himself subject to observation and analysis. It is not my intention to undertake a philosophic-theoretical discussion – I wish to report some considerations about praxis of the annotation process with cognitive approach. It is my full conviction that an annotator does, above all, an introspective activity (with what degree of awareness does not matter) – he questions himself above all – with this process he tries to determinate which inferences he would use to connect temporarily or casually the story events. To identify inferential mechanisms ascribable to the spectator, CT often executes an **induction process** from his real life – he attributes to the spectator a certain rule of inference as he himself possesses (in his real life) such rule, and assumes that also the spectator possesses it.

These considerations could diminish the value of the theory proposed in this book (and of others adopting a cognitive approach of analysis) as it results that every kind of formulation is an annotator's point view, and different theories exist – one for every annotator. I believe that a theory with cognitive approach can be validated by the clarity and in the strictness of the annotator's attribution (for example if you adopt, or don't adopt, a formalism for the annotations) – and above all from the degree sharing with a reference community of the attributions proposed.

1.3 REVISION OF SPECTATOR'S COGNITIVE STATE

The spectator's revision model I propose is composed of various cognitive activities, that are activated after every filmic segment (I will be clearer later about the kind of segment) is shown in the diegesis (see figure 1.3.1.)

The schema of the figure 1.3.1 hides a very strong assumption: the spectator's perceptive activity precedes the inferential activities (more strictly cognitive) leading to execute the consistence analysis regarding the spectator's cognitive state.

I am aware that this separation is not what it might exactly happen in the spectator, who before having finished his perceptive process could begin his inferential activity on the acquired events. However, the aim of this book is not to explore what exactly happens in the spectator's mind, but to propose a model to explain the main phenomena of the spectator's comprehension concerning stories of the movies. Obviously, the construction of a model presupposes a simplification and consequently some renounces.

Observing the figure 1.3.1, the spectator from the visual and auditive perception of a filmic segment, creates new beliefs about story events of the kind $\mathtt{bel(Spx, Ex)}$. Each new belief, once analyzed and inserted in the cognitive space, can create other new beliefs, in relation to events only partially described, or not explicitly presented in the story. A spectator who sees on the screen a person who is sleeping in a house, a curtain that is moving, and an

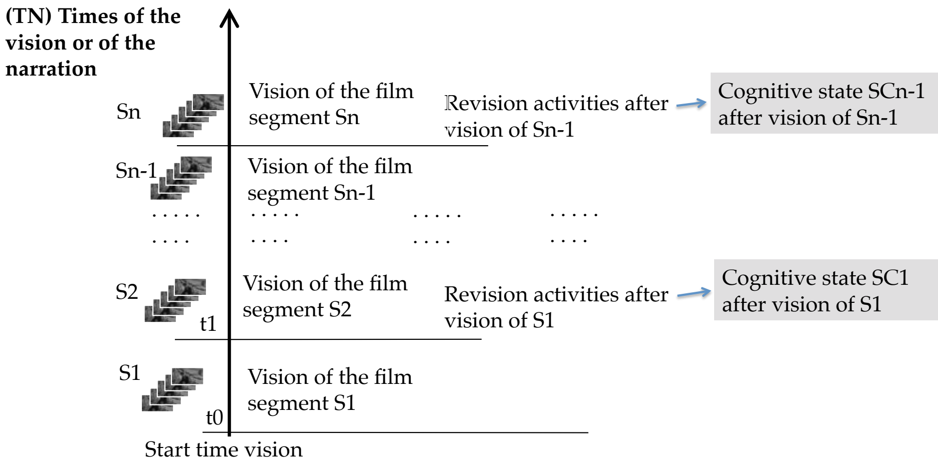


Figure 1.3.1: Discretization of the mental states revision

open window, can believe that an intruder has entered the house. The spectator hasn't seen the person, he has inferred it by the simple cognitive rule he owns: a character who sleeps, can't have moved the curtain or opened the window – so someone has entered the house. After any new belief about a story event, the spectator carries out an analysis regarding the consistence (3.), to discover if there are contradictory assumptions. The spectator cannot accept in a same cognitive instant, that exist events which are mutually exclusive. For example he cannot accept that in a same story there exist two events that occur in the same railway station, in the same hour and day, and on the same train track, and that a same person can "catch the train and can't catch it"[14].

In the same phase of consistence analysis, there is also an activity of restoring the mental state consistency, if he discovers that for some events an inconsistence occurs (I will return many times in this book on the subject that concerns the revision of the viewer's mental state). Generally a spectator in a temporal instant Tx has a cognitive state formed of the acquired beliefs until the instant Tx that I will indicate with $\mathsf{belState}(\mathsf{Spx}, \mathsf{Tx})$.

14 The example given is obviously a clear allusion to the events present in the movies *Sliding Doors* [SlidingDoors] and *Blind Chance* [BlindChance], where a person in a same railway station and in the same time interval catches or doesn't catch the train.

The beliefs are of different typologies – each can contribute to the formation of the spectator's cognitive state:

$$
\begin{array}{ll}
\mathsf{belState}(Spx, Tx) =_{def} & \\
\cup_n \mathsf{mev}(Tx, \mathsf{bel}(Spx, En))) & \text{\% Beliefs about happened events.} \\
\cup_{j,k} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{bel}(Pj, Ek))) & \text{\% Beliefs on the characters' beliefs.} \\
\cup_{s,t} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{int}(Ps, Et))) & \text{\% Beliefs on the characters' intentions.} \\
\cup_{f,t} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{goal}(Pf, Et))) & \text{\% Beliefs on the characters' goals.} \\
\cup_{x,y} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{prec}(Ex, Ey))) & \text{\% Beliefs on the order of events.} \\
\cup_{x,y} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{over}(Ex, Ey))) & \text{\% Beliefs on the overlapping of events.} \\
\cup_{r,q} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{eq}(Er, Eq))) & \text{\% Beliefs on events happening} \\
 & \text{\% on the same intervals.} \\
\cup_{z,m} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{belongMacr}(Cvex, Ez))) & \text{\% Beliefs on events belonging} \\
 & \text{\% to course of events.} \\
\cup_{c,d} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{cause}(Ec, Ed))) & \text{\% Beliefs of events that cause other events.} \\
\cup_{m,n} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{sameE}(Em, En))) & \text{\% Beliefs about the identity of two events.} \\
\cup_{x,y} \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{sameP}(Px, Ey))) & \text{\% Beliefs on the identity of two characters.}
\end{array}
\tag{1.3.1}
$$

In addition to the beliefs $\mathsf{belState}(Spx, Tx)$, there is the set of the inference rules $\cup_v R_v(Spx, Tx)$ that are also part of the spectator's cognitive state. The spectator uses such rules to pass from a cognitive state to a successive one. These rules can lead to a simple increment of the spectator's beliefs or to an elimination of the previous acquired beliefs[15]. These rules can lead to a simple increment of the spectator's beliefs or to an elimination of some previously acquired beliefs.

The operations regarding the elimination of the knowledge by the spectator's cognitive state are necessary when some contradictions among the spectator's beliefs are discovered. The spectator has some cognitive mechanisms through which he tries to keep his cognitive state without any contradiction. I have used the word "tries" because sometimes the spectator is obliged in some stories to accept the existence of local contradictions and sometimes total, that make the fabula of the story insubstantial.

The cognitive state $CSx(Spx, Tx)$ has two arguments: Spx to denote that the cognitive state depending by a specific spectator, and Tx to denote the temporal instant in which are valid the spectator's beliefs and the inferential rules:

$$Csx(Spx, Tx) =_{def} \mathsf{belState}(Spx, Tx), \cup_v R_v(Spx, Tx)$$

15 The theory of the revision of the beliefs proposed by Alchourrón, Gardenfors e Makinson [Alchourron1985] has been an important referral both for the application of the sector and for others theoretical developments on the belief revision.

The revision rules $\cup_v R_v(\mathtt{Spx}, \mathtt{Tx})$ are inserted in a revision cycle of the spectator's beliefs – these rules in my model can vary over time. This characteristic of model is useful in spectator's revision activity in which he, besides operating a revision of the beliefs on the story events, learns new reasoning rules or makes a revision of some existing rules. This happens in particular in some movies, where fantastic events and laws on imaginary worlds are present. For these movies, the spectator's inferential patrimony is not determined only by the rules he owns *inherited* from his daily life, but it is built also through rules valid in particular fantascientific worlds, these latest often suggest to the spectator of considering some unpublished (and false) physical laws.

In my model I assume that during the interval $\mathtt{tm}$-$\mathtt{tn}$ of vision, related to a filmic segment $\mathtt{Sn}$ (see figure 1.3.1), every spectator's cognitive activity of revision is inactive. According to this hypothesis of discretization, the spectator sees a certain segment $\mathtt{Sn}$, and, only after the end of such vision, he begins the revision activities of the beliefs (revision of his cognitive state).

I wish to underline that the spectator inserts a new belief ($\mathtt{bel}(\mathtt{Spx}, \mathtt{Ex})$) in his cognitive state, and subsequently he makes a check to verify the consistence of his current cognitive state or of a possible expansion of it. If there are not contradictory reasons (for example it doesn't exist one or more beliefs, previously acquired, that are incompatible with the belief we are acquiring) then the spectator confirms his new belief in his mental state or eliminates (if possible) the beliefs responsible of the incompatibility.

It is to consider that, generally, in a first moment, the spectator tends to accept the new beliefs coming out from the vision of story events, and then rejects these, if some "reconsiderations" arise due to the development and acquisition of new facts in the story. In many cases present in the movies stories, the spectator really believes that an event has happened, then it happens that this conviction leads him to some contradictory, and then he is obliged to retract what he has believed. Between the two options, if to choose a model that foresees to accept a new belief after a *strong* initial test, or a model in which, firstly you accept a new belief without a rigorous check, and then you reject it when a contradiction occurs - I have chosen the second option.

If the beliefs won't be accepted we could not explain how the expectation, surprises and suspense could be generated. If the spectator dubiously or critically accepts the new beliefs, how can arise in him emotions? How does the spectator to generate inside him emotions if he does not believe that the facts really happened in the story?

If $Sx(Spx, Tx)$ constitutes the spectator's cognitive state at the time Tx, and I_i the perceptive act of Spx in relation to the vision of a filmic sequence, then Spx will switch in a new cognitive state through a revision of the current cognitive state, determined by the application of the revision rules $\cup_\nu R_\nu(Spx, Tx)$:

$$S_{i+1}(Spx, T_{i+1}) = Rev(I_i, CS_i(Spx, T_i))$$

In cognitive terms, after the vision of a filmic segment S_i, the spectator's mind, according with his cognitive state, will execute a cognitive causation[16]:

$$CS_{i+1}(Spx, T_{i+1}) \leftarrow_{Me} CS_i(Spx, T_i) \tag{1.3.2}$$

COGNITIVE STATES REPRESENTED WITH CONDITIONS OF CAUSAL SUFFICIENCY. Every rule that I will give, in the formalism used in this book for representing the passage between two spectator's cognitive states, has the form of a causal formal rule $CS2 \leftarrow_{Me} CS1$, in which in the definition is respected the (meta)condition of causal sufficiency:

> A cognitive state $S1$ is casually sufficient for another cognitive state S2, if in presence of $S1$, S2 always happens. In other words, if S1 is a sufficient cause for S2, then $S1$ never happens without S2, notwithstanding $S2$ may happen also without $S1$.

I give an example causal sufficiency between two cognitive states. In two scenes are put on stage two events $E1$ and $E2$, where in $E1$ a character A sends a letter to another character B, and in $E2$ B reads the letter and becomes angry. If the spectator believes that $E1$ has caused $E2$ (mental state $S1$ – $bel(Spx, cause(E1, E2))$), then has to believe also that $E1$ precedes $E2$ (mental state $S2$ – $bel(Spx, prec(E1, E2))$). According the revision rule reported, the mental state $S1$ is sufficient for the mental state $S2$. However, the mental state $S2$ ($bel(Spx, prec(E1, E2))$) could have been acquired by the spectator, also if in the scene of the letter sending by A (in $E1$) would have been reported a calendar date, and in $E2$ (at the moment of the letter reading

16 In this formula I have indicated the mental causation with the symbol $\leftarrow_{Me}$. In the following in this book I will use the notation $\leftarrow$ without the subscript Me.

by B) would have been reported another calendar date with a time following the one presented in E1. The spectator's inference would have been also in this case $bel(Spx, prec(E1, E2))$.

Moreover, the cognitive state S2 could have been generated in the spectator also if a character in the story would have referred to another character (or also if a extradiegetic voice) would have uttered "A has sent the letter to B, after that B has read the letter, B became angry".

The causal condition of sufficiency could be a very useful "meta condition" (in particular for the scriptwriters) to individuate the set of the possible choices – places, characters and actions – to be put on scene to lead the spectator to a determined cognitive state.

EXPLANATION AS CAUSATION AMONG COGNITIVE STATES OF THE SPECTATOR. The cognitive theory for the movie comprehension I am presenting, has been constructed starting from the following methodological points:

1. A spectator's cognitive state CSx is represented through: the beliefs on the story events; the beliefs on the characters' mental states; the beliefs on the temporal order of the events; the beliefs on the causal relation among events and beliefs on the revision rules;
2. Every spectator's cognitive state, in a time T_{i+1} is determined – after the vision of a new filmic segment Sx – through the application of a set of revision rules $Rj(Spx, T_i)$ existent in the spectator's cognitive state at time T_i;
3. Spectator's revision rules are represented as causal rules with conditions of sufficiency;
4. A phenomenon of comprehension F (that constitutes a cognitive state SF), is explained if, from the spectator's vision of the filmic segments $Seg1$, $Seg2$,..., $Segn$, is possible to individuate a causal sequence of spectator's cognitive states $CS_n, CS_{n-1}, \dots, CS_2, CS_1$ that respect the points 1, 2 and 3 and SF is present in CS_n.

In this way, the explanation of a mental phenomenon is represented by a casual chain of spectator's cognitive states of the kind:

$$\begin{aligned}&CS_n(Spx, T_n) \leftarrow_{Me} CS_{n-1}(Spx, T_{n-1}), \ldots,\\&CS_2(Spx, T_2) \leftarrow_{Me} CS_1(Spx, T_1)\end{aligned}$$

in which SF is represented in $CS_n(Spx, T_n)$.

Many existing cognitive theories are formulated in terms of some relevant cognitive states, such as the expectation, the surprise, and the incongruity. A theory with cognitive orientation for the movie comprehension must be constructed with the presupposition that spectator's mental phenomena have to be explained through a causal chain of relevant cognitive states. For instance, if a suspense is generated in the spectator, it must be justified (explained) through a determined causal chain of cognitive states.

TWO KINDS OF CAUSAL RELATION FOR THE STORY EVENTS. In the models regarding movie stories, there are two kinds of causal relations – the first regards spectator's belief that a determined diegetic event $E1$ causes another diegetic event $E2$. In my formalism I will represent this rule as a Spx's cognitive state $CS_x(Spx, Tx)$ in the following way:

$$mev(Tx, bel(Spx, cause(E1, E2)))$$

The second casual relation regards the cognitive causation of the spectator's mental state:

$$CS_n \leftarrow_{Me} CS_{n-1}$$

To better clarify the two types of causality, I consider a rule affirming that if a spectator Spx believes that $E1$ causes $E2$ and believes that $E2$ causes $E3$, then Spx believes that $E1$ causes $E3$. In formalism proposed:

$$\begin{aligned}&mev(Tx, bel(Spx, cause(E1, E3))) \leftarrow_{Me}\\&\ mev(Tx, bel(Spx, cause(E1, E2))),\\&\ mev(Tx, bel(Spx, cause(E2, E3))).\end{aligned}$$

The inference involves three causal relations – $\mathit{cause}(E1, E3)$, $\mathit{cause}(E1, E2)$, and $\mathit{cause}(E2, E3)$ – as arguments of spectator's belief, and the rule "$\leftarrow_{Me}$" representing the causation of two mental states:

$$CS_2 \leftarrow_{Me} CS_1$$

in which:

$$\begin{aligned} CS_2 &=_{def} \ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{cause}(E1, E3))) \cup CS_1. \\ CS_1 &=_{def} \ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{cause}(E1, E2))), \\ & \qquad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{cause}(E2, E3))). \end{aligned}$$

LOCAL AND GLOBAL ASPECT OF STORIES. Structural aspects of stories analyzed in this book are collocated in two big categories: local and global aspects. A local structural aspect, as can be a basic narrative figure, as the ellipsis or the flashback, concerns only two events of a story, and is recorded in only one spectator's cognitive state, while an global structural aspect, as the fragmentation of a story, his global consistence (if a story is close or open) and the narrator's point of view (the focalization), regards many story events, and then many spectator's cognitive states.

Often a generic spectator has an immediate consciousness about the local phenomena, demonstrated by the fact that he possesses and uses names, to label an interruption of the story (name as "flashback", "ellipsis", and so on). About global phenomena, often the spectator has only a sensation of *something* that is present in the telling, but he hasn't the full awareness. Regarding a phenomenon of open or close stories for example, he can have a sensation that he is in presence of something unusual, because he observes a temporal contradiction among events, but he can't perceive the phenomenon from a global point of view, nor applies a formal definition of contradiction to a set of events. Regarding contradictions phenomenon the spectator so don't use the term "open" fabula, also if he perceives the *discomfort* of not knowing how to reconstruct the temporal axis.

The complexity in a story or its fragmentation, are concepts pertaining to a cinema theorist, also if to determine a measure or a degree of these aspects, the same theorist uses the change of cognitive states possessed by the spectator and uses local aspects.

1.4 THE SPECTATOR AND HIS COGNITIVE RULES OVER TIME

In this book are given spectator's cognitive rules when watching a movie. To do this, it is necessary to first answer a hypothetical question about who is the spectator to whom we refer when we propose these rules of reasoning. The answer is that we are referring to a generic spectator of which we are interested to construct a explanation model of why he comprehends the causal links among the events, and the relations of this latter about the temporal order. The spectator to which we are referring to, necessarily has not knowledge on theories of the movies (on shooting techniques, editing and so on), nor possesses a specific knowledge acquired previously from the vision of other movies.

Even if we consider the spectator to be only of one kind, he changes over time (his basic beliefs and his cognitive rules) – this happens because inevitably he improves his knowledge (he interacts with the real world) and his ability in the comprehension of stories (he sees new movies). Many rules I report in this book, are destined (sooner or later) to be obsolete (I hope that with the same rapidity, also the methods I propose won't become obsolete). This occurs because after every new cognitive trap, created by the author of a movie in which the spectator is deceived, surprised and so manipulated, the spectator activates a learning process.

If until a determined moment of the cinema history, the spectator has believed that the extradiegetic voice says always the truth, and he assumes as true everything, after the release of movies such as *Rashomon*[17] and *The Usual Suspects*[18], he believes that rule no longer valid (or if he still applies it, in some cases he does not it apply in an ingenuous way, just he has done before).

Moreover, if in the first movies on time travels, the spectator was ready to swear that in a fictional world was possible to come back to the past, but that no one could modify the present from which it was departed, after having seen the trilogy of *Back to the future* or other movies violating this rule, he

17 [Rashomon]
18 [TheUsualSuspects]

learns the rule that this is possible – and it is a possibility he uses later in his inferences to comprehend other movies presenting time travels.

In this statute of freedom where is possible to infringe every existent rule – in the cinema is allowed – the spectator is at the mercy of the movie author's creativity. All the spectator's basic inferences, are in this way intrinsically subjected to revision over time, including of course, those I will present in this book.

2 EVENTS IN SPECTATOR'S MIND

I adopt the beliefs as basic entity to represent the spectator's cognitive state. In the sector of the Artificial Intelligence, the cognitive state of a rational agent[1]in general is represented through three main mental attitudes of the agent: objectives (goals), intentions (int) and beliefs (bel). In carrying out action plans, a generic agent, with cognitive capacities, is moved by intentions and goals. The spectator, having no possibilities of doing actions – can't interact in any way with the represented and false of the story events – we imagine him sitting in front of the screen – invested by the images of the movie, capable only of generating cognitive actions, producing hypothesis or emotions, only by what is present on the screen.

The spectator as the story evolves, constructs different typologies of beliefs – in my representation I take into account the ones listed on paragraph 1.3, among these there is the belief $\mathtt{bel(Spx, Ex)}$ – which has to be read as: the spectator believes the event $\mathtt{Ex}$ happens in the story.

2.1 SPECTATOR AND EVENTS OF THE STORY

The segmentation of a movie in basic elements such as the frame, the scene, or the sequence, has always been object of analysis by movie scholars. Already from the first theoretical hypotheses proposed by Metz[2], has arisen an essential question to which has not yet been provided a clear answer "which is the basic unit for the segmentation?". P. Montani suggests that the filmic text, to be segmented, must be understood:

1 In Artificial Intelligence has been developed in the last 20 years a prolific research area based on rational agent models denominated DBI (Desire, Belief, Intention). In this research area, I quote some pioneering works: [Shoham93], [Rao1995], [Wooldridge1995] and [Woldridge2000].

2 See [Metz1972]

> it is that the text generally constructs its regularities in relation to the global comprehension of his sense and not vice versa[3]

By accepting P. Montani's indication – to rely on sense – it occurs then, for the comprehension of a movie, to choose an unit of sense for the segmentation, and to associate to it, the temporal indexes related to the beginning and ending vision of the unity chosen. However, which unit do we have to choose for the movie? In a cognitive approach, the choice, in a nearly obliged manner, falls on the "event of the story", a choice motivated by the fact that a spectator watching a movie is principally interested to the story:

> among the many roads the cinema could take, it has privileged the one of narration. The restrictive criterion, so, is also a selective criterion: it is arbitrary in the theoretical profile (it could have been chosen another)....it is sure that our feeling of cinema, is a narrativity feeling, the cinema is one of the great regimes of the «narrative»[4].

By adopting these indications, if the spectator is interested to the story, for obvious reasons interested in the events belonging to it. The spectator's interest makes choose the event, as basic diegetic element for the segmentation of a movie, as on it he directs his attention and his cognitive forces for the comprehension of the story. So, in the approach I am adopting, many classical elements regarding the punctuation of the filmic text, as the frame, the scene, the sequence and so on, are often secondary to the determination of the story segmentation – the events determine this latter.

The hypothesis is that the spectator selects only *accomplished* events inside the diegesis – as consequence, he forces a punctuation of a semantic nature in the filmic text – he chooses diegetic events, no keeping into account (or by giving little importance) if these entities belongs to a scene, to a sequence or to a single frame[5].

---

3 The sentence is by P. Montani and is reported in the introduction in [Metz1989]

4 Ibid., p. 16

5 The cognitive approach chosen for the analysis of the movie, will lead us to formally redefine many narrative figures such as flashbacks and ellipses. However, in this book I will not try to redefine traditional structure as frame, sequence, etc. When in the early chapters of this book I use the term "sequence" which has to be interpreted in qualitative term – as a generic group of events or scenes. In chapter 7 I introduce a new structure for the segmentation of

Figure 2.2.1: Mikei at the bar drinking a beer in *The killing*

2.2 REPRESENTATION OF STORY EVENTS

In the discussion in the previous paragraph it has been emphasized the importance of the events in the movie story comprehension. According to the central role that these entities play, I propose a formal representation of event inspiring itself to the journalistic one of the 5w (what, when, where, who e why). Such representation is composed by 5 components: *what* happens in an event – regarding generally the action happening in a diegetic interval; *when* – regarding the (diegetic) interval in which the event happens; *where* the event takes place; *who* – the participant (or the participants) to the event; and in the end *why*, regarding the cause of a specific event – a causal relation (or a set of causal relations) among a story event and one or other story events. In figure 2.2.1 I report a freeze frame of the movie *The killing*, in which in a scene is shown the event of a boxer named Mikei, who is in a pub drinking a beer, in a certain diegetic interval (`td1,td2`). The event 'Mikei in a bar drinking his beer' in my formalism is represented in the following way[6]:

the film "the macro event" having a formal definition. This latter has some similarity to the ordinary sequence, but differs from this, as to its inside contains essential causal conditions that bind the story events, and plays a key role to represent, from a cognitive point of view, some global structural properties of stories.

6 A formalism based on five w (when, what, who, where, why) very similar to the one adopted in this book, is in [Mele2013].

$$
\begin{array}{ll}
\mathit{diegeticEvent}(ex). & \text{\% ex is a diegetic event.} \\
\mathit{when}(ex, on([td1, td2])). & \text{\% ex happens on the interval } [td1, td2]. \\
\mathit{what}(ex, drink(mikei, bear)). & \text{\% the action of the event ex is "to drink".} \\
\mathit{who}(ex, mikei). & \text{\% the participants in the event ex are Mikei} \\
\mathit{who}(ex, barman). & \text{\% and the barman.} \\
\mathit{where}(ex, bar) & \text{\% the place where the event ex.}
\end{array}
\tag{2.2.1}
$$

Through the expression $why(E2, cause(E1, E2))$ I represent the *why* of an event $E2$ that for readability reasons, I represent as $cause(E2, E1)$[7]. When necessary I take into account also the relation $cause(E1, E2, \ldots, En)$[8], where more events $E1, E2, \ldots, Em$ are cause of a determined En. Anyway, it is my conviction that from a cognitive point of view, the spectator constructs his reasoning, starting from beliefs that have one, or maximum two events, as cause of an event, and rarely starting from beliefs of casual chains of events – although he often applies causal rules of transitivity between events, as ones that I reported in the paragraph 1.3.

I report an example of causal relation present in *The killing*, regards the quarrel provoked by Mikei into the bar. Such event has been caused by a previous conversation between John and Mikei, in which John convince (under payment) Mikei to provoke the quarrel.

The representation of the event reported in a stop-motion is shown in 2.2.2.

$$
\begin{array}{l}
\mathit{diegeticEvent}(ey). \\
\mathit{when}(ey, on([td1, td2])). \\
\mathit{what}(ey, convince(john, go(mikei, bar))). \\
\mathit{who}(ey, john). \\
\mathit{who}(ey, mikei). \\
\mathit{where}(ey, club).
\end{array}
\tag{2.2.2}
$$

7 $cause(E2, E1)$ has the following meaning: the event $E1$ is the cause of the event $E2$. We note that, by a strictly formal point of view, the relation $cause(E1, E2)$, does not concern a single event. We can imagine that exists a composed event $E3$ of which $E1$ and $E2$ are components. The component "why" then does not belong to a single event but belongs to entities where the events are aggregated, for instance a story. Regarding the notion of complex event and the relative formal and representational questions consider [Mele2011], [Mele2013]

8 cause (E1, E2,. . . , En) is an abbreviation of:

$$cause(E1, E2), cause(E2, E3), \ldots, cause(Em, En)$$

Figure 2.2.2: John convinces Mikei to provoke a brawl in *The killing*

Moreover, it exists a causal relation – $cause(ex, ey)$ – between the event ex described in 2.2.1 and the event ey defined in 2.2.2.

WHEN AN EVENT HAPPENS In my formalism the exact interval in which an event happens, is represented through the expression:

$$when(Ex, on([Tdi, Tdf]))$$

where Tdi is the instant in which the event begins and Tdf the instant in which it ends. Very often the diegetic temporal instants Tdi e Tdf aren't known, so when an event Ex happens is represented through one (or more) temporal qualitative relation, between $[Tdi, Tdf]$ with another diegetic interval or with another story event. In table 2.2.3 I report the kinds of temporal relations existing among the events (or among events and intervals) and their representations in the formalism proposed in this book.

$\mathit{diegeticEvent}(Ex).$	% Ex is a diegetic event	
Ex on his interval of happening		
$\mathit{when}(Ex, \mathit{on}([Td1, Td2]).$	% Ex happens on diegetic % interval $[Td1, Td2]$	
Ex in relation to intervals	% interval $[Td1, Td2]$	
$\mathit{when}(Ex, \mathit{during}([Td1, Td2]).$	% Ex happens in the diegetic % interval $([Td1, Td2])$.	
$\mathit{when}(Ex, \mathit{before}([Td1, Td2]).$	% Ex happens before the diegetic % interval $([Td1, Td2])$.	
$\mathit{when}(Ex, \mathit{after}([Td1, Td2]).$	% Ex happens after the diegetic % interval $([Td1, Td2])$.	
Ex in relation to instants		
$\mathit{when}(Ex, \mathit{until}(Tdx)).$	% Ex happens until the % diegetic time Tdx.	(2.2.3)
$\mathit{when}(Ex, \mathit{start}(Tdx)).$	% Ex happens starting from the % diegetic time Tdx.	
$\mathit{when}(Ex, \mathit{after}(Tdx)).$	% Ex happens after the % diegetic time Tdx.	
$\mathit{when}(Ex, \mathit{before}(Tdx)).$	% Ex happens before the % diegetic time Tdx.	
$\mathit{when}(Ex, \mathit{atTime}(Tdx)).$	% Ex happens at the % diegetic time Tdx.	
Ex in relation to others events		
$\mathit{when}(Ex, \mathit{eq}(Ex, Ey))$	% Ex happens on the same interval of Ey	
$\mathit{when}(Ex, \mathit{prec}(Ex, Ey))$	% Ex happens before Ey	
$\mathit{when}(Ex, \mathit{over}(Ex, Ey))$	% Ex overlaps Ey	

I have included in the representation of events also the form $\mathit{atTime}\ (Tdx)$ as well. This because, even if events in the nature happen on intervals, for many expressions of natural language, the spectator considers the events to happen on temporal instants.

In their essential form, the story events are represented through actions happening over time (in natural language for example through verbs and tenses), and also through any entities (nominal groups)[9] – as: "the football match", ", "the bombing of the town" and "Indians assault to the diligence". Here "the match", "the bombing" and "the assault" are entity (substantives) denoting events happening during a period. I represent this last kind of events, through

9 For the events annotation in natural language is used the formalism *TimeML* [TimeML]. *TimeML* for different natural languages has been adopted. For the Italian language I report as referral [Caselli2010].

the same set of descriptors adopted for the events in form of action occurring over time.

As I will show, in my formalism ”real” events will not be represented. My attention will be placed on the spectator’s beliefs having as arguments diegetic events:

$$bel(Spx, Ex), bel(Spx, when(Ex, on([Td1, Td2]), bel(Ex, Actx), ..etc$$

ACTIONS AND EVENTS - A REPRESENTATION TO DISTINGUISH THEM. In my representation, the action, that is *what* happens in an event, can contain entities belonging also to the description of the event. If in the example given in figure 2.2.1 you try to characterize Mikei’s action[10]drinking beer, it must be represented through the predicate ”to drink” having Mikei and beer as arguments. These last two entities are also the participants to the event, which has a broader list of participants, such as the barman and the clients of the bar. The event compared to the action has also other attribution such as *when*, *where*, *who* and *why* that do not contribute to the description of the action, but only of the event.

From a linguistic-cognitive point of view, a common sense analysis regarding how the rational agents use the words “action” and “event”, doesn’t give any useful indication for distinguishing the two terms, as often concepts are used in interchangeable way. It is not a case that some important theories of events, do not distinguish the two concepts[11]. In this book I are going to distinguish these entities, considering the action as a component of the event – representing *the what* – while the event as *something* happening over time. The representation showed in 2.2.1 puts in evidence this distinction - the arguments of the action (Mikei and Beer) and the participants to the event (Mikei, barman) are different: the barman is a participant in the event, but is not an argument in the action of Mikei’s drinking. In this way, also the bar, the place in which the action happens, it is a component of the event, but it is not for the action.

10 The action of an event is represented through a predicate having n arguments $p(x1, x2, ..., xn)$. Examples of action representation are: $grab(John, gun)$, $dress(Mary, dress, white)$, and so on.

11 In the famous theory of the *Event Calculus* [Kowalski1986] for example, there is not any distinction between actions and events.

2.3 SPECTATOR'S BELIEFS ON THE STORY EVENTS

The beliefs in some theories[12] are considered as relations between an agent Ag, intended as subject of the belief, and an utterance α intended as object of the belief. In this approach, the beliefs have the form:

$$\mathrm{bel}(Ag, \alpha)$$

Concerning the domain of the analysis to which we are interested α represents events of the story. As further refinement, I take in consideration the beliefs as properties varying over time[13]:

$$\mathrm{mev}(Tx, \mathrm{bel}(Spx, Ex)) \quad \begin{array}{l}\text{\% At the time } Tx\text{, the spectator believes}\\ \text{\% the diegetic event } Ex \text{ happens.}\end{array} \tag{2.3.1}$$

I represent spectator's beliefs as fluents – a kind of mental events having a creation time (a time corresponding to a visual, verbal...perceptive act), an interval of permanence (validity), and that can cease to be valid[14]. The stimulus of beliefs generation is given to the spectator through the sequences of the images, which when interpreted, constitute diegetic events becoming arguments of spectator's beliefs. To give an example of representation, I take into account a story event present in *Before the rain*[15], the one regarding the

12 An important theoretical propose for the treatment of the beliefs, very near to the one adopted in this book, is the "syntactic approach of the beliefs" – the more representative research in this ambit has been that of K. Konolige [Konolige1986], who has presented an alternative approach to possible worlds. [Hintikka1969], [Kripke1975].

13 The introduction of the notion of mental attitudes (as the beliefs) that varies over time is due to J. Barwise, [Barwise1983], and has been later adopted also by Y. Shoham in [Shoham1993]. Other forerunners references of belief theories that vary over time are [Giangrandi1997] and [Matthias1995]. More recent works on beliefs and time have been produced in [Bonanno2007] where it is introduced an axiomatization of the revision of beliefs in a logic formalism.

14 The adopted approach is similar to the persistence of fluents proposed to the one in the theory of the Event Calculus [Kowalski1986], [Miller2002], [**Muller2006**]. I have represented the beliefs as fluents, ie as properties that begin to be worth at certain instant, persist in time and cease to be worth with the happening of some event.

15 [BeforeTheRain]

Figure 2.3.1: Monk hitting the fly in *Before the rain*

novice monk who hits (or tries to hit) a fly on his own neck. This event in the model of the spectator's mind is represented through beliefs in the following way:

$$mev(t2, bel(Spx, when(ex, on([tdn, tdm])))).$$
$$mev(t2, bel(Spx, what(ex, hitting(monk, fly)))).$$

Where $t2$ is the instant in which the belief starts to be valid. With this choice, I represent the persistence of the spectator's cognitive state[16]: the beliefs on the events happened in the story or on temporal order relations among the events, once registered in spectator's mind, persist until others events of the story induce the spectator himself to erase or modify these beliefs.

Obviously, in the representation chosen also the spectator's beliefs (Spx) on the temporal relations between events ($prec(E1, E2)$, $eq(E1, E2)$, and

16 I will call this property as the principle of spectator's mental state persistence. In general, as a topic, the persistence of the properties is well known in research communities of the Artificial Intelligence dealing with reasoning of common sense, as the principle of inertia – in particular it constitutes a fundamental axiom of the Event Calculus - see [Kowalski1986], [Miller2002], [**Muller2006**].

Figure 2.3.2: Photo of Sonia and Guido in *The Double Hour*

over(E1, E2)) vary over time, that is are fluents that start, persist and cease to be valid – the representation is the following:

```
mev(Tx, bel(Spx, prec(E1, E2))).   % Spx believes that E1 precedes E2.
mev(Tx, bel(Spx, over(E1, E2))).   % Spx believes that E1 overlaps E2.
mev(Tx, bel(Spx, eq(E1, E2))).     % Spx believes that E1 and E2 happen
                                   % on the same interval
                                   % (are simultaneous)
```

The choice to represent, in a variable manner over time, also the beliefs on temporal relation among events, is an obliged choice, as these relations change in a movie story – the spectator due to a lack of complete knowledge, assumes in a first moment some beliefs on the order of the events, but in some cases he must revise them, when new story events that are in conflict with those already recorded, happen. In the movie the *Double Hour* there is a meeting between the two protagonists in a speed date, an event that the spectator records as a first meeting between Guido (Filippo Timi) and Sonia (Ksenia Rappoport). After that in the narration the police commissioner (friend of the protagonist Guido) shows Sonia a photo, telling her he had found it in Guido's house – it is a photo showing Sonia and Guido together, made in Buenos Aires. The spectator looking at this photo can't do anything else that suppose that it has been made before the meeting in the speed date between Guido and Sonia. In fact, this assumption is a revision of his beliefs on the temporal order of the events – until that moment, the first meeting was the one at the speed date.

Also if this event surprises Sonia and the spectator himself, he has followed step by step the story between Sonia and Guido and believes that there hasn't been the time (in the story of Sonia and Guido) to live the experience of a travel to Buenos Aires – evidently he overshadows this incongruity - supposing in his mind that there have been other events in the story unknown to him and patiently expects the carrying out of the event. The spectator will also remove this belief, for who hasn't seen the movie. Later in the telling, the story reveals that the event of the photo showed her by the police commissioner has been only Sonia's mental vision, when she was in the hospital – in such way the story that the spectator has seen on the screen, until that moment, has been only Sonia's mental projection as she is in coma.

Here have been reported superimposed and confused elements of real and false events, happened facts and Sonia's desires. In the example given there are so different changes on beliefs regarding the temporal order of the events, that need a variable over time representation.

2.4 COGNITIVE PRIMITIVES OF STORY EVENTS

In this paragraph I make a supposition regarding the primitives the spectator uses to infer that an event has happened (I discuss about inference in the next paragraph). The list regarding the primitives here reported hasn't the objective to present a theory of the perception of events, but rather to introduce the representation, with the related meaning, adopted in this book.

TO BELIEVE THAT AN EVENT HAPPENS ON A DIEGETIC INTERVAL. The first primitive component for an event I report is the spectator's belief regarding the diegetic interval $[Td1, Td2]$ on which the spectator believes a story event happens:

$$bel(Spx, when(Ex, on([Td1, Td2]))) \tag{2.4.1}$$

The formalism 2.4.1 is adeguated for inserting the interval in which an event happens [`Td1,Td2`] in a succession of other intervals (in which other events happen)[17].

Every time the spectator watches images on the screen, he believes that a time in the story has passed and *always* believes that something has happened. In addition, when images, in which the spectator does not recognize what has happened, are projected, a scene for example that proposing only noises or light flashes instead of actions – also in these cases, he has always the *sensation* that something has happened. Some cinematographic theories[18] in which, in correspondence with an absence of characters' actions, there is a pause of the story. In a cognitive approach to the analysis of the film, it affirms that **the spectator always perceives a diegetic time that passes**, also when there aren't actions, characters or events present on the screen. When a landscape is framed, or when in aerial shots on the screen are shown countrysides, mountains, seas and beaches (images often linked to a pause on the story), there is always a time flowing – it's an interval hosting the effect of a travel time, of an emotion, that the spectator lives, together with the airplane that flies over those spaces, and this happens also if the spectator doesn't see the airplane. In such way to believe that an event has happened, the spectator has to believe that a certain time has passed.

---

17 I report a basic article [Block1990] in which are distinguished three main aspects of psychological time:

> psychological time is constituted by three main aspects: the succession, the duration and the temporal perspective. The succession is relative to the happening of events in sequence, from which someone can subsequently perceive the temporal order. The duration is referred to different characteristics of the events. Every event happens on a determined period that an individual can interpret and remember. The events are separated by period of time that can contain other events and the length of the interval plays a role in various aspects of psychological time. A series relatively unified of events is an episode that goes on for a determined period that a person can identify and record. Temporal perspective, the third aspect of psychological time here discussed is referred to the experiences of a person and the conception regarding past present and future.

18 I refer to what affirmed for example in [Rondolino2011] p. 34 that follows G. Genette's thought in [Genette1986]

The time $Td1$ and $Td2$ present in 2.4.1, can represent also a diegetic chronological time, reported in the diegesis through clocks, calendar, captions – utterances such as "at a minute past 3pm", "in the diegesis", "Monday, 3rd march" and so on. These last are not always present (shown) in the diegesis.

In my representation diegetic intervals, represented as $[Td1, Td2]$, do not have a numerical value (unless are used as chronological diegetic times) – I will use them as symbolic intervals. Nonetheless, these intervals constitute referral terms to construct temporal relations ("it comes first then", "it comes after then"). Symbolic expressions $[Td1, Td2]$ allow us to have a representation, in the spectator's cognitive space, to execute events anchoring on the story temporal axis. As example I report the definition of simultaneity between two events $E1$ and $E2$[19]:

$$\begin{aligned} & mev(Tx, bel(Spx, eq(E1, E2))) \leftarrow \\ & \quad mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))), \\ & \quad mev(Tx, bel(Spx, when(E2, on([Td1, Td2])))), \\ & \quad not\ sameE(E1, E2). \end{aligned} \tag{2.4.3}$$

The primitive we are examining can be in the spectator's cognitive space also if the event has never happened. For example – the spectator, hearing a character, can believe that an event will happen in the story – he then records among his beliefs that exists a certain temporal interval in which this event will happen, also if he is not authorized to record the happening of the event. The primitive of when an event happens can be used as condition to determine for example an expectation state in the spectator of a story event.

19 In the definition I have excluded the possibility that $E1$ and $E2$ are the same events. The expression $sameE(E1, E2)$ has the following definition $sameE(E1, E2)$ has the following definition:

$$sameE(E1, E2) \leftarrow diegeticEvent(E1),\ diegeticEvent(E2),\ E1 = E2. \tag{2.4.2}$$

Other primitives of "when" component, regarding the temporal modality in which an event happens, are:

$$\begin{aligned}&bel(Spx, when(Ex, after([Td1, Td2]))).\\&bel(Spx, when(Ex, prec([Td1, Td2]))).\\&bel(Spx, when(Ex, on([Td1, Td2]))).\\&bel(Spx, when(Ex, in([Td1, Td2]))).\end{aligned} \tag{2.4.4}$$

Starting from the primitive $bel(Spx, where(Ex, on([Td1, Td2]))$, I define a notion of an event duration, as follows:

$$\begin{aligned}&mev(Tx, bel(Spx, dur(Ex, D))) \leftarrow\\&\quad mev(Tx, bel(Spx, when(Ex, on([Td1, Td2])))),\\&\quad hasValue(Td1, V1), hasValue(Td2, V2),\\&\quad D = V2 - V1.\end{aligned} \tag{2.4.5}$$

I represent the diegetic instants Tdx with the symbols td1, td2, .., tn, to which we can associate a value in the following expression:

$$diegeticTime(Tdx), hasValue(Tdx, Vx)$$

The inference 2.4.5 represents the relation between two events having the same duration:

$$\begin{aligned}&mev(Tx, bel(Spx, sameDur(E1, E2))) \leftarrow\\&\quad mev(Tx, bel(Spx, dur(E1, D))),\\&\quad mev(Tx, bel(Spx, dur(E2, D))),\\&\quad not\ sameE(E1, E2).\end{aligned} \tag{2.4.6}$$

There is a chronological time duration, external to the diegesis regarding the narration time, to which the spectator cannot subtract himself. In many cases the real and diegetic duration of an event are perceived in the same manner by the spectator, and the chronological duration of the narration becomes the spectator's reference to determine the duration of the diegetic story events[20].

20 See the section "Speed of diegetic events and narration time" 3.1, in the chapter 3

BELIEVING AN ACTION HAS TAKEN PLACE. I take into consideration the spectator's mental state about his belief on a story event:

$$bel(Spx, what(E1, Ax)) \tag{2.4.7}$$

I suppose that for this primitive the spectator has a kind of *internal database* of typical actions constructed by the experience of his real life. The spectator compares every action presented in the diegesis to his acquired repertoire of real actions, to operate a classification and to determine the kind of belonging. Obviously, every kind or category of an action identified, needs a specialization, and for every action a modality in which the action happens exists. The action of closing the door of a room, for example can be execute slowly or sharply – by accompanying it with hands or with a kick.

Beyond categorization problems, there is a interesting aspect regarding the typical durations of the real actions and those of the actions presented in the diegesis: such durations are different (topic I will retake in chapter 3).

An action in a filmic representation is put on stage – generally – through typical times: a man walking, will go with a speed that does not exceed two seconds, a leaf falling from a tree, will fall more slowly than a character falling from a skyscraper and the motion of a projectile, will be represented (generally) with a speed so that the spectator won't see the trajectory of the projectile itself.

This happens in the most part of the diegetic actions. Notwithstanding the relation between natural time in the action and his speed of projection, is not a parameter established a priori, it can be chosen by the movie's author, who executes the choice for its efficacy of representation or for the emotions he wants to generate in the spectator. So a bullet entering into a wall, sometimes is shown with a slowdown, so that the spectator can follow its trajectory, or the falling of a feather can be reported in an accelerated way, so that the spectator can't pay attention to it. The duration of the vision, and the one typical of the action, are so independent variables, whose ratio can be equal to 1 or when the action is projected in its natural time, or less or greater than 1, when you operates a temporal slowdown or an acceleration (see chapter 3).

BELIEVING THAT A CHARACTER PARTICIPATES TO AN EVENT. *Who* participates to the event of a stoty is another primitive component in the process of believing that an event has happened:

$$\mathrm{bel}(Spx, who(Ex, Wox)) \tag{2.4.8}$$

This belief could not be present in the presentation of an event, as in the same event there aren't participants – or if the presence or the identity of a character has been hidden with intentionality by the author of the story. I distinguish two processes concerning the participant (or the participants) to an event:

a) the process of updating and revision of the character's attributes;
b) the process of identification of a character.

The process a) regards all the times in which new aspects, new character's attributes are shown, or a revision (a deleting) of them occurs. During this process are archived a series of information – whose details vary in according with characters' aspects and author's presentation strategy in the narration. The information regards: the name (if it is referred), sex, age (when it is present), or through a qualitative enunciation in the filmic text of labels such as "middle age man", "a young with a gash on his face", "a colored woman" and so on.

The first time that a character is shown, the spectator constructs a partial structure, a kind of frame filled with information available at that moment of the story. This frame, in successive times in which the character appears in the story, will be incremented with new attributes or new instances of attributes.

The *minimum* knowledge the spectator *assigns* to a character is the name, that is not necessarily a proper name – any designator is suitable – most often is an epithet[21].

> ...the names are deictics, that is indicators, marked in a definite way, or cut by an infinite, supposed and catalogued (also if in a minimum manner). So the narratives don't need of proper nouns in a strict sense. All the diegetics can be: a personal pronoun, an

21 In the text reported in [Chatman2010], p. 136 I have inserted the phrase "in the first time it appears in the story" instead of "in the first sentence", this to adapt the definition to the filmic context.

epithet (“the man with a beard”, “the woman in blue”) or also a demonstrative pronoun or the definite article, (you may refer to the character as “a man” only one time – the first time he appears in the story. After you will call him ”the man”)

The spectator, in this way, can assign both a name and an epithet to a character, or to both. Often occurs this latest case when in a first apparition for a determined character Px, the name hasn’t been uttered. Also often the name of a character Px is revealed in the story when another character calls Px with his name.

From the second time on a character Px appears in the story, the spectator increments (or revisions) the initial structure constructed for Px. In this operation it is also necessary a filter activity to eliminate eventual incongruity or contradictions that can happen in the story.

Before adjourning with new attributes the knowledge relating to a character, the spectator has to undertake an operation of identification (point b) – a process sometimes simple other times complex – that is to recognize the character. This cognitive operation is activated when for instance a character shown in older age, is successively presented in the narration in elder age, or also in those cases in which a character in two narration times is represented with an aspect completely different. In all these cases, it is necessary a cognitive activity of comparison, through which the spectator has to solve the problem ”is the character $P1$ the same character $P2$”?:

$$bel(Spx, sameP(P1, P2))?$$

To answer to this question the spectator will compare the attributes (the properties) he recorded for $P1$ and $P2$.

I introduce a basic cognitive rule I have called *inference of the character’s name* that uses the property ”name” of two characters for resolving the problem $bel(Spx, sameP(Py, Px))?$. This relation establishes that two characters having the same name are the same characters. The rule is the following: Spx believes that Py and Px are the same characters if the spectator Spx believes that: Px takes part in the event Ex; Py takes part in the event Ey; Nx is the name of Px; Ny is the name of Py; Ny and Nx have the same name (the same value of the subject property). In a formal way:

$$\begin{aligned}
&mev(Tx, bel(Spx, sameP(Py, Px))) \leftarrow \\
&\quad mev(Tx, bel(Spx, who(Ex, Px))), \\
&\quad mev(Tx, bel(Spx, who(Ey, Py))), \\
&\quad mev(Tx, bel(Spx, propEv(Ex, prop(name, Px, Nx)))), \\
&\quad mev(Tx, bel(Spx, propEv(Ey, prop(name, Py, Ny)))), \\
&\quad mev(Tx, bel(Spx, sameV(Ny, Nx))).
\end{aligned} \tag{2.4.9}$$

I don't know any movie in which the rule 2.4.9 has been violated. At this point I desire to ask one question: in future films, will the rule be 2.4.9 valid for ever?

As stated previously many of the rules introduced in this book will not be respected in the future films - authors and directors (in the prerogative of their work) are always in search of narrative forms to surprise the viewer.

What will happen then when the 2.4.9 rule is not respected?

The inference of the character's name has a kind of generalization in a rule, maybe less strong than the previous, but likewise valid for the spectator and affirming that if a character Pa possesses one or more specific properties of another character Pb (shown or not in the story), then the spectator infers that Pa and Pb are the same characters. This rule, I formally present in paragraph 5.7 is a generalization of 2.4.9 inference, being a character's name only a specific property of the character himself.

TO BELIEVE THAT AN EVENT HAPPENS IN A DETERMINED PLACE. For the primitive of "where" happens an event:

$$bel(Spx, where(Ex, Wrx)) \tag{2.4.10}$$

it is valid everything it has been said regarding the characters of an event. *Where* happens an event, may not be initially identified from what has been shown into the diegesis. There are two processes for the "where" component of event – the one of classifying for the first time a place and the one of comparison between two places; the places of an event don't require proper names, but some epithet are used, such as "in the house near the lake", "in the killing room", "in the country of the bearded character" and so on.

A particular aspect of belief $bel(Spx, where(Ex, Wrx))$, regards the second time that a place is presented, in which the spectator does not always execute an updating of the place attributes. These last can radically change in a second presentation and in the following. This occurs as you can show a place during different day hours, different seasons, and in some cases a place can be entirely destroyed. The belief on the names places, notwithstanding the transformations, always keeps the belief initially recorded by the spectator.

TO BELIEVE THAT AN EVENT (OR MORE EVENTS) CAN CAUSE ANOTHER EVENT. A fundamental primitive to link the events in a story is:

$$bel(Spx, cause(Ex, Ey)) \tag{2.4.11}$$

that is the spectator believes that the event Ex causes Ey. The 2.4.11 with respect to the previous primitives doesn't regard only an event, but two or more events - as it is a relation interesting the story.

Causal rules are in my representation an argument of the spectator's belief. Spectator's casual rules are similar to the one present in the situations of common sense (imported from the real world), and also in the stories set in fantastic worlds. These rules are completely new to the spectator – far from his experience and daily routine – they can be created in the spectator's cognitive space, in a some time interval of the narration, and will be used by the spectator itself later in the film vision. The primitive $bel(Spx, cause(Ex, Ey))$ is very important in the spectator's reasoning activities, as it allows to link temporally a very high number of events present in the stories, this happens through the following cognitive rule[22]: Spx believes that Ex precedes Ey if he believes that: Ex happens Ey happens; and Ex is the cause of Ey.

$$\begin{aligned}
&mev(Tx, bel(Spx, prec(Ex, Ey))) \leftarrow\\
&\;\; mev(Tx, bel(Spx, Ex)),\\
&\;\; mev(Tx, bel(Spx, Ey)),\\
&\;\; mev(Tx, bel(Spx, cause(Ex, Ey))).
\end{aligned}$$

22 The rule proposed is the cognitive version of an axiom enough known and shared among the causal theories (see Tooley2000 p. 268), having the form: if $E1$ causes $E2$ then $E1$ precedes $E2$. My rule constitutes a cognitive version – under belief – of the rule above given.

I will return on this rule many other times in this book (in the chapter 5). Actually I emphasize that the inference conditions given, require that the events Ex and Ey have yet to happen in the story, and the causal connection (the relation $cause(Ex, Ey)$) has not yet been individuated by the spectator.

There are cases in which the inference can't be applied, as the story hasn't shown the knowledge needed to permit the spectator to individuate the event Ex (Ex is the cause of Ey) – this happens for example when there is an ellipsis in the telling.

Generally after every new event Ey shown in the story, the spectator always searches a belief that regards a causal connection between Ey and the event Ex that may have been the cause of Ey – so, the spectator wonders: which event has caused Ey? This question is a cognitive primitive existing in every spectator assisting to any type of story (filmic, literary or spoken), generally it constitutes the basic element pushing a user of a story to search a causal and temporal link among all the story events[23].

EVENTS NAME. The considerations made regarding the characters' name in a story are valid also for the events name. The spectator attributes names to the events in form of epithets, mostly constituted by nominal groups to better identify the events, "the bank robbery", "the bomb explosion", ecc. The epithet form is also used to indicate partial story or courses of events inside the entire story of the movie.

THE REPRESENTATION OF PROPERTIES AND ROLES. In my formalism diegetic properties and roles are represented as diegetic fluents[24] – so

---

23 The spectator beside the causal-temporal rule reported, has other causal reasoning rules that permit him to individuate new causal links among events, not yet recorded by the spectator. We can suppose, for example that a generic spectator has a transitive rule for causal relations:

$$\begin{aligned} &mev(Tx, bel(Spx, cause(E1, E3))) \leftarrow \\ &\quad mev(Tx, bel(Spx, cause(E1, E2))), \\ &\quad mev(Tx, bel(Spx, cause(E2, E3))). \end{aligned} \tag{2.4.12}$$

A causal axiomatic that can be applied for the spectator's causal reasoning is in [Mele2013].

24 The fluents and events are the basic entities of the Event Calculus Theory [Kowalski1986], [Miller2002], and [**Muller2006**].

too spectator's beliefs, that are considered as mental properties, having an instant of beginning and persist over time.

As for events, we can represent fluents as arguments of the spectator's beliefs, adopting the following definition: the spectator Spx beliefs that Fpropx is a property fluent if Spx beliefs that the fluent Fpropx is true at diegetic time Tdx, Spx beliefs that the fluent Fpropx has the property Propx, Propx is a property, and Tdx is a diegetic time. Formally:

$$\begin{array}{l} mev(Tx, bel(Spx, propFluent(Fpropx))) \leftarrow \\ \;\; mev(Tx, bel(Spx, whereF(Fpropx, Tdx))), \\ \;\; mev(Tx, bel(Spx, whatF(Fpropx, Propx))), \\ \;\; property(Propx), \\ \;\; diegeticTime(Tdx). \end{array} \tag{2.4.13}$$

With the term $\mathsf{property(Propx)}$ so defined:

$$\begin{array}{ll} property(Propx) \leftarrow & \text{\% Propx is a property if} \\ \;\; hasPrName(Propx, Pname), & \text{\% Propx has name Pname,} \\ \;\; hasPrSubject(Propx, Subjx), & \text{\% Propx has a subject Subjx,} \\ \;\; hasPrValue(Propx, Valuex). & \text{\% Propx has a value Valuex.} \end{array} \tag{2.4.14}$$

In my representation the property subject (the term Subjx in 2.4.13) is a participant to a story event (character or object). I report some examples of properties as fluent.

The filmic situation "At diegetic time td1, paul is wounded" is represented as spectator's beliefs in this way: spx beliefs that $\mathsf{fp1}$ is true at diegetic time $\mathsf{td1}$; spx beliefs that $\mathsf{fp1}$ has the property $\mathsf{pr1}$; $\mathsf{pr1}$ name is physical_condition; $\mathsf{pr1}$ has paul as subject; and $\mathsf{pr1}$ has $\mathsf{wounded}$ as value. Formally:

$$\begin{array}{l} mev(Tx, bel(spx, whereF(fp1, td1))). \\ mev(Tx, bel(spx, whatF(fp1, pr1))). \\ hasPrName(pr1, physical\_cond). \\ hasPrSubject(pr1, paul). \\ hasPrValue(pr1, wounded). \end{array}$$

”At diegetic time td2, the t-shirt is red” is represented as: spx beliefs that $\mathsf{fp2}$ is true at diegetic time $\mathsf{td2}$; spx beliefs that $\mathsf{fp2}$ has the property $\mathsf{pr2}$; $\mathsf{pr2}$ name is colour; $\mathsf{pr2}$ has $\mathsf{t\text{-}shirt}$ as subject; and $\mathsf{pr2}$ has red as value.

$$
\begin{array}{l}
\mathsf{bel(spx, whereF(fp2, td2)).}\\
\mathsf{bel(spx, whatF(fp2, pr2)).}\\
\mathsf{hasPrName(pr2, colour).}\\
\mathsf{hasPrSubject(pr2, t\text{-}shirt).}\\
\mathsf{hasPrValue(pr2, red).}
\end{array}
$$

A property can be associated to a story event: a property of an event can be sporty, harmful, terrifying and so on. The properties of the events, can sometimes constitute sufficient conditions (even if weak) to execute specific inferences (see paragraph 7.7), also without knowing in detail how an event has happened – sometime without even knowing "what has occurred", a fundamental component to the event description.

A role interests two story participants, and it regards two characters (or a character and a social entity). A role has the following definition: Spx beliefs that Frolx is a role fluent if: Spx beliefs that Frolx is true at diegetic time Tdx, Spx beliefs that Frolx has the role Rox, Tdx is a diegetic time, and Rox is a role. In formal way:

$$
\begin{array}{l}
\mathsf{mev(Tx, bel(Spx, rolFluent(Frolx)))} \leftarrow\\
\quad \mathsf{mev(Tx, bel(Spx, whenF(Frolx, Tdx))),}\\
\quad \mathsf{mev(Tx, bel(Spx, whatF(Frolx, Rox))),}\\
\quad \mathsf{role(Rox), diegeticTime(Tdx).}
\end{array}
\tag{2.4.15}
$$

With $\mathsf{role(Rox)}$ so defined:

$$
\begin{array}{ll}
\mathsf{role(Rox)} \leftarrow & \%\ \text{Rox is a role if:}\\
\quad \mathsf{hasName(Rox, RoleName),} & \%\ \mathsf{RoleName}\ \text{is the name of Rox,}\\
\quad \mathsf{hasRoParticipant1(Rox, P1),} & \%\ \text{a participant of role is}\ \mathsf{P1},\\
\quad \mathsf{hasRoParticipant2(Rox, P2).} & \%\ \text{a participant of role is}\ \mathsf{P2}.
\end{array}
\tag{2.4.16}
$$

I report below some examples.
The filmic situation ”At diegetic time $\mathsf{td1}$, Marsellus is the husband of Mia”

is represent as: spx beliefs that $frol1$ is true at diegetic time $td1$; spx beliefs that $frol1$ has the role $ro1$; the name of role is $husband$; a participant of $ro1$ is $marsellus$; and a participant of $ro1$ is mia. Formally:

$$mev(tx, bel(Spx, whenF(frol1, td1))).$$
$$mev(tx, bel(Spx, whatF(frol1, ro1))).$$
$$hasRoName(ro1, husband).$$
$$hasRoParticipant1(ro1, marsellus).$$
$$hasRoParticipant2(ro1, mia).$$

The filmic situation "At diegetic time $td2$, Paul is the lover of Christina" is represent as: spx beliefs that $frol2$ is true at diegetic time $td2$; spx beliefs that $frol2$ has the role $ro2$; the name of $ro2$ is $lover$; a participant of $ro2$ is $paul$; and a participant of $ro2$ is $christina$. In formal way:

$$mev(tx, bel(spx, whenF(frol2, td2))).$$
$$mev(tx, bel(spx, whatF(frol2, ro2))).$$
$$hasRoName(ro2, lover).$$
$$hasRoParticipant1(ro2, paul).$$
$$hasRoParticipant2(ro2, christina).$$

The filmic situation "At diegetic time $td3$, Jesse is the chief of police" is represent as: spx beliefs that $frol3$ is true at diegetic time $td2$; spx beliefs that $frol3$ has the role $ro3$; the name of $ro3$ is $chief$; a participant of $ro3$ is $jesse$; and a participant of $ro3$ is $police$.

$$mev(tx, bel(spx, whenF(frol3, td3))).$$
$$mev(tx, bel(spx, whatF(frol3, ro3))).$$
$$hasRoName(ro3, chief).$$
$$hasRoParticipant1(ro3, jesse).$$
$$hasRoParticipant2(ro3, police).$$

A role is often acquired by the spectator in a story through a character's act of telling ("he is my husband", "he is the team coach", "he is my boss", and so on) or it is inferred after an event, for example in a scene it is shown a man Px, marrying a woman Py ($marry(Px, Py)$), since that moment (until they divorce), Px is the husband of Py ($husband(Px, Py)$). As I will see later, a role can be an object of spectator's beliefs – an example of inference representation that creates a belief on the role of being husband, is given in 2.7.

A spectator's belief about a property that is valid during the occurrence of an event, is an useful concept to represent some spectators' mental conditions. I report the definition:

$$\begin{aligned}
&mev(Tx, bel(Spx, propEv(Ex, prop(Pname, Subject, Valuex)))) \leftarrow \\
&\quad mev(Tx, bel(Spx, whatF(Frol, Propx))), \\
&\quad hasPrName(Propx, Pname), \\
&\quad hasPrSubject(Propx, Subject), \\
&\quad hasPrValue(Propx, Valuex), \\
&\quad diegeticEvent(Ex), \\
&\quad who(Ex, Subject), \quad roleFluent(Frol).
\end{aligned} \tag{2.4.17}$$

In the case that the property is not expressed as a function of a participant, and if we know the diegetic time of validity, we can consider the following representation:

$$\begin{aligned}
&mev(Tx, bel(Spx, propTd(Tdx, prop(Pname, Subject, Valuex)))) \leftarrow \\
&\quad mev(Tx, bel(Spx, whenF(Fpropx, at(Tdx)))), \\
&\quad mev(Tx, bel(Spx, whatP(Fpropx, Propx))), \\
&\quad hasPrName(Propx, Pname), \\
&\quad hasPrSubject(Propx, Subject), \\
&\quad hasPrValue(Propx, Valuex).
\end{aligned} \tag{2.4.18}$$

Similarly to the properties, I define a notion of role that is valid in relation to an event:

$$\begin{aligned}
& mev(Tx, bel(Spx, roleEv(Ex, rol(Rname, P1, P2)))) \leftarrow \\
& \quad mev(Tx, bel(Spx, whatF(Frol, Propx))), \\
& \quad hasName(Propx, Rname), \\
& \quad hasRoParticipant1(Propx, P1), \\
& \quad hasRoParticipant2(Propx, P2), \\
& \quad mev(Tx, bel(Spx, who(Ex, P1))), \\
& \quad roleFluent(Frol).
\end{aligned} \tag{2.4.19}$$

While the spectator's belief about a role that is valid at a certain diegetic time Tdx, can be represented as:

$$\begin{aligned}
& roleTd(Tdx, rol(RoleName, P1, P2)) \leftarrow \\
& \quad roleFluent(Frolx), \\
& \quad mev(Tx, bel(Spx, whenF(Frolx, Tdx))), \\
& \quad mev(Tx, bel(Spx, whatF(Frolx, Rox))), \\
& \quad role(Rox), \\
& \quad hasName(Rox, RoleName), \\
& \quad hasRoParticipant1(Rox, P1), \\
& \quad hasRoParticipant2(Rox, P2).
\end{aligned} \tag{2.4.20}$$

2.5 THE VISION ACT

The theory I present proposes a principle of perception-belief that regulates the acquisition of the beliefs regarding events explicitly shown in the diegesis. I consider the vision act of a movie segment $Segx$, as an action similar to a speech act[25], in which are generated some beliefs in the interlocutor. Regarding the filmic text, the vision act involves the generation of beliefs in

25 Referring to the literary text and concerning the act of fiction G. Genette writes: "it seems that the utterance intentionally fictitious can be reasonably described as no serious assertions (or no literary) hiding, to the indirect linguistic act (or of the figure), declarations (or requests) of explicit fiction."

the spectator's cognitive state (CS), and concerns the components of an event Ex[26].

We can assume that the spectator performs perceptive acts for each component of an event ($visActWt$, $visActWn$, $visActWo$, and $visActWr$). For the "what" component of the event: Spx believes that $Actx$ is the action of Ex if: the visual act about $Actx$ happens; $Segx$ is a filmic segment; $Actx$ is a diegetic action; and Ex is a diegetic event. In a formal way:

$$
\begin{aligned}
& mev(T2, addbel(bel(Spx, what(Ex, Actx)))) \leftarrow \\
& \quad time(T2), \\
& \quad spectator(Spx), \\
& \quad visActWt([T1, T2], Spx, Segx, Actx, Ex), \\
& \quad hasIntTime(Segx, [T1, T2]), \\
& \quad diegeticAction(Actx), \\
& \quad diegeticEvent(Ex).
\end{aligned} \tag{2.5.1}
$$

26 The theory I present takes its starting point by different theories of different sectors. The principle proposed by J. Barwise [Barwise1983] – suggested that the act of seeing is the first action to be considered. J. Barwise proposes a principle of truthfulness:

if A sees X then X

where for "then X " means "it is true that X ".
I believe that the filmic text context does not involve the concept of truth – it is about events of fiction in which X did not really happen, but has happened in a story. Both G. Genette and Searle have formulated theories on *no serious* speech acts, with the aim to characterize the communicative acts in literature. They have addressed the analysis of the illocutionary acts, without doing any hypothesis about what happens in the perlocutionary acts.
Among all the theories proposed on speech acts the contribution of J. Allen and C.,R. Perrault [Perrault1980] seems to be the nearest to the context of the spectator watching a movie, as they consider the perlocutionary act as a cognitive action generating beliefs in the receiver of the communicative act.
A research on linguistic acts has been done by H. Bunt in [Bunt2011] and [Bunt2010], where a semantic for the dialogue act has been proposed.

For the ”when” component of the event: Spx believes that Ex happens on $[Td1, Td2]$ if: the visual act about $[Td1, Td2]$ happens, $Segx$ is a filmic segment; $[Td1, Td2]$ is a diegetic interval; and Ex is a diegetic event.

$$\begin{aligned}&mev(T2, addBel(bel(Spx, when(Ex, on([Td1, Td2]))))) \leftarrow\\ &\ visActWn([T1, T2], Spx, Segx, [Td1, Td2], Ex),\\ &\ hasIntTime(Segx, [T1, T2]),\\ &\ diegeticInt([Td1, Td2]),\\ &\ diegeticEvent(Ex).\end{aligned} \tag{2.5.2}$$

For the ”where” component of the event: Spx believes that Ex happens in the space Wr if: the visual act about Wr happens; $Segx$ is a filmic segment; Wr is a diegetic space; and Ex is a diegetic event. Formally;

$$\begin{aligned}&mev(T2, addBel(bel(Spx, where(Ex, Wr)))) \leftarrow\\ &\ time(T2)\\ &\ spectator(Spx),\\ &\ visActWr([T1, T2], Spx, Segx, Wr, Ex),\\ &\ hasIntTime(Segx, [T1, T2]),\\ &\ diegeticSpace(Wr),\\ &\ diegeticEvent(Ex).\end{aligned} \tag{2.5.3}$$

For the ”who” component of the event: Spx believes that Pn is a participant in the Ex if: the visual act about $P1$ in the Ex happens; $\ldots$; the visual act about Pn in the Ex happens; $P1$; $\ldots$; Pn are diegetic participants; $Segx$ is a filmic segment; and Ex is a diegetic event.

$$\begin{aligned}&mev(T2, addBel(bel(Spx, who(Ex, Pn)))) \leftarrow\\ &\ time(T2),\\ &\ spectator(Spx),\\ &\ visActWo([T1, T2], Spx, Segx, Pn, Ex),\\ &\ diegeticParticipant(Pn),\\ &\ hasIntTime(Segx, [T1, T2]),\\ &\ diegeticEvent(Ex).\end{aligned} \tag{2.5.4}$$

We can define the spectator's belief about an diegetic event Ex as the logical conjunction of the belief components what, when, who and where (2.5.3, 2.5.4, 2.5.2, and 2.5.1):

$$\begin{aligned}
&\mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathsf{Ex})) \leftarrow \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Ex}, \mathsf{Act}))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{when}(\mathsf{Ex}, \mathit{on}([\mathsf{Td1}, \mathsf{Td2}])))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{who}(\mathsf{Ex}, \mathsf{Pn}))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{where}(\mathsf{Ex}, \mathsf{Wr}))).
\end{aligned} \tag{2.5.5}$$

To believe that something happened in the story, it's enough that the spectator believes that has passed a determined diegetic temporal interval, independently that he has a clear idea of *what* has happened in an event, of *who* has participate to it, and of *where* has happened the event[27].

We can formulate a principle of perception-beliefs through the notion of vision act that we can define as the logical conjunction of viewer's percep-

27 Often in the diegesis events, of which the spectator does not identify what has happened, nor who has taken part, nor where it has happened, are shown. This occurs why the author (screenwriter or direction) hides intentionally these knowledge. For this kind of filmic events, without to modify the definite formalism reported, we can assume the symbology $\mathit{what}(\mathsf{Ex}, \mathit{unknown})$, $\mathit{where}(\mathsf{Ex}, \mathit{unknown})$, $\mathit{who}(\mathsf{Ex}, \mathit{unknown})$, to indicate the components of the events not known to the viewer. In the limit case in which the spectator perceives only a diegetic time passing, the inference is the following:

$$\begin{aligned}
&\mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathsf{Ex})) \leftarrow \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{when}(\mathsf{Ex}, \mathit{on}(\mathsf{Td1}, \mathsf{Td2})))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Ex}, \mathit{unknown}))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{where}(\mathsf{Ex}, \mathit{unknown}))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathit{bel}(\mathsf{Spx}, \mathit{who}(\mathsf{Ex}, \mathit{unknown}))).
\end{aligned}$$

that is to read: " the spectator believes that happened an event about which he does not know the action, the participant and the place".

tual acts and the beliefs acquired by the spectator himself from such acts of perception[28]:

$$\begin{aligned}
&\mathit{mev}(\mathsf{T2}, \mathit{addBel}(\mathit{bel}(\mathit{Spx}, \mathsf{Ex}))) \quad \leftarrow \\
&\ \mathit{hasIntTime}(\mathit{Segx}, [\mathsf{T1}, \mathsf{T2}]), \\
&\ \mathit{visActE}([\mathsf{T1}, \mathsf{T2}), \mathit{Spx}, \mathit{Segx}, [\mathsf{Td1}, \mathsf{Td2}], \mathsf{Ex}), \\
&\ \mathit{diegeticTime}(\mathsf{Td1}), \mathit{diegeticTime}(\mathsf{Td2}), \\
&\ \mathit{time}(\mathsf{T1}), \mathit{time}(\mathsf{T2}), \mathit{diegeticEvent}(\mathsf{Ex}).
\end{aligned} \tag{2.5.7}$$

where $\mathsf{T2}$ is the end time (a chronological time of the narration) of the filmic segment presentation Segx, Ex the diegetic event the spectator Spx believes has happened, and $[\mathsf{Td1}, \mathsf{Td2}]$ is the diegetic interval in which Spx believes Ex happens. In this model, time (chronological) Tx was put in correspondence with time in which the spectator's belief begins to be true, after Tx the belief persists, until when in the narration new events happen, so to induce the spectator to a revision of this belief.

I anticipate that there are other indirect activities of the spectator (a topic I will discuss in chapter 5.5), leading the acquisition of beliefs on the component of an event, as for instance, a character Px saying that an event has happened Ex – $\mathit{bel}(\mathit{Spx}, \mathit{say}(\mathsf{Px}, \mathsf{Ex}))$. In such cases also if Px describes precisely Ex – the event has not shown in the diegesis – Px believes (if is in good faith) that this event has happened in the past.

The spectator Spx can infer rules leading the acquisition of beliefs on indirect events, only after he has seen and heard by the character Px that the story event Ex has happened, that is only after the application of the principle perception-belief.

28 The definition of $\mathit{visActE}$ is the following:

$$\begin{aligned}
&\mathit{visActE}([\mathsf{T1}, \mathsf{T2}), \mathit{Spx}, \mathit{Segx}, [\mathsf{Td1}, \mathsf{Td2}], \mathsf{Ex}) \quad =_{\mathit{def}} \\
&\ \mathit{visActWn}([\mathsf{T1}, \mathsf{T2}], \mathit{Segx}, \mathit{on}([\mathsf{Td1}, \mathsf{Td2}], \mathsf{Ex})), \\
&\ \mathit{visActWo}([\mathsf{T1}, \mathsf{T2}], \mathit{Segx}, \mathsf{Pi}, \mathsf{Ex}), \mathit{visActWo}([\mathsf{T1}, \mathsf{T2}], \mathit{Segx}, \mathsf{Pn}, \mathsf{Ex}), \\
&\ \mathit{visActWt}([\mathsf{T1}, \mathsf{T2}], \mathit{Segx}, \mathit{Actx}, \mathsf{Ex}), \\
&\ \mathit{visActWr}([\mathsf{T1}, \mathsf{T2}], \mathit{Segx}, \mathit{Wr}, \mathsf{Ex}), \\
&\ \mathit{diegeticParticipant}(\mathsf{Pi}), \mathit{diegeticParticipant}(\mathsf{Pn}), \\
&\ \mathit{diegeticSpace}(\mathit{Wr}), \mathit{diegeticAction}(\mathit{Actx}), \\
&\ \mathit{diegeticTime}(\mathsf{Td1}), \mathit{diegeticTime}(\mathsf{Td2}), \\
&\ \mathit{time}(\mathsf{T1}), \mathit{time}(\mathsf{T2}), \mathit{diegeticEvent}(\mathsf{Ex}).
\end{aligned} \tag{2.5.6}$$

The diegetic events E_i as a dream, a nightmare, a desire and so on, have certainly happened in the diegesis, but the events E_i that through them are reported require additional spectator's inferences to be admitted among the facts (certainly) happened into the story.

After a vision act $visAct([T1, T2], Spx, Segx, [Td1, Td2], what(Ex, Actx)$ the spectator will record:

mev(Ty, bel(Spx,what(Ex, say(Pa, Ey))))	if $Actx$ is an act of telling of a character Pa;
mev(Ty, bel(Spx,what(Ex, dream(Pa, Ey))))	if $Actx$ is a dream by Pa;
mev(Ty, bel(Spx, what(Ex, see(Pa, Ey))))	if $Actx$ is an act of seeing by Pa;
and so on.	

In all these cases the events indicated with Ex are events directly perceived by spectator, while the events indicated with Ey are not. In such a way for each events Ey, the belief $bel(Spx, Ey)$ is not valid, but will can be acquired by the spectator if Ey is reported later in the story or can be inferred by the spectator himself, if he believes that there are the conditions to believe that Ey has really happened.

In some stories it occurs that, for a same event the spectator's beliefs are different from those believed by the characters. At these case there isn't contradiction between the character's point of view, and what the spectator sees (believes) happening in the diegesis.

If a character Px refers that hasn't stolen a particular necklace from a drawer and in the diegesis it is shown a scene in which Px takes this necklace, the spectator won't perceive an inconsistence in the story because the event of "not stealing" is referred by Pa, while the one reported in the story has believed happened by Px. I will discuss about the arguments above listed in chapter 6, in which I dealt with character's inner state.

The discussion I anticipated has the only aim to underline that the representation and the model I propose, considers the events *perceived* by characters and not only the ones given in the diegesis[29]. Concerning the acquisition of the beliefs, I have chosen a model that in a first moment inserts every belief generated by the perception of filmic segment $Segx$ (the expression $mev(Tx, addBel(bel(Spx, Ex)))$ indicates that the belief is inserted in the spectator's current mental state) – only after having inserted the new belief

29 The author thanks Professor Cristiano Castelfranchi who with a personal e-mail years ago, gave enlightening suggestions on the events not directly happened in the diegesis.

the spectator will apply the consistency control of his mental state (considering the new belief inserted). The filter I propose can be described in the following manner:

1. from the act of vision the spectator acquires one (or more than one) belief Bx without conditions, nor filter depending by beliefs still present in his cognitive state;
2. the spectator will apply a consistency control to the new cognitive state determined by the new belief Bx acquired at point 1. If there no contrary reasons to accept Bx then the belief will persist in his actual mental state, otherwise the spectator activates some rules (that he certainly owns) to build a new cognitive state, by changing or eliminating other previously acquired beliefs ($mev(Tx, remBel(bel(Spx, Ex)))$ is the operation to eliminate a belief from the spectator's cognitive state).

The problem of the revision of knowledge (and of the beliefs) has been from many years topic of study in Artificial Intelligence field - my proposal in this book isn't to review and formulate a new review model[30]. As I will see later, I have proposed a model to discovery of inconsistencies and of the relative eliminations, based on rules depending by the particular event that has to be accepted in the cognitive space. For example if two events $E1$ and $E2$ can't coexists in a story, however they are both presented in the telling, then the spectator will possess (and activates) some rules to eliminate one of the two beliefs relating to $E1$ and $E2$ or to believe that $E1$ and $E2$ belongs to courses of alternative events (this happens as I will see in many counterfactual stories presenting alternative courses of events). If for each event Ea there is no

30 The models I propose, as I shall see, are almost always formulated through local revision rules, so that the viewer can manage locally inconsistencies through rules of restoring his cognitive state. These rules will only affect on some of the acquired beliefs and are formulated to "predict" some inconsistencies typical of the stories. For example, for the counterfactual stories, in which is reported in the story an inconsistency between two events that can not happen either in the same story, the spectator's restoration action of his cognitive status will consist in assuming that the narrative is taking into consideration two alternative stories. For particular stories (stories defined open where you can not eliminate inconsistencies, this topic will be discussed in the section 7.10) I formulate some models where are not allowed propagation effects of the inconsistency. I propose a representation that leaves some inconsistent cognitive states - this is in fact what makes the viewer when it is forced to abandon any attempt to eliminate the inconsistency, not for his inability but to the intrinsic form (open) of the story, to abandon any attempt to eliminate the inconsistency.

other event Ey that can exclude the occurrence of Ea ($bel(Spx, Ex\ Xor\ Ea)$) then we can say that the cognitive state of the spectator is not contradictory. If, on the other hand, it happens that between the viewer's beliefs there are two events that are or exclusive then we can say that the viewer's cognitive state is inconsistent. I have chosen a condition of inconsistency in terms of or-exclusion among events, as it seems nearer to spectator's cognitive activities. Indeed the spectator doesn't carry out refined and global controls on the events believed to happen, in the same way it does a logic consistency control performed by a deductive logic program.

The spectator carries out simple and localized checks leading to immediate contradictions, this implies that he does not always discovers and then eliminates eventual inconsistencies present in his cognitive state – the telling and the images on the screen go on regardless the spectator's inconsistency cognitive states – sometimes the movie finishes and we find him still to order the puzzle pieces (regarding these arguments I will speak later in this book). An only vision act can generate the acquisition of beliefs relating to more events in spectator's mental state. This occurs, for example, when there are more events present in the same frame happening in the same diegetical interval, or when the intervals of the events are overlapped – we can represent these situations with the notation:

$$visAct([T1, T2], Segx, [Td1, Td2], [E1, E2, .., En])$$

We also can use the last notation to denote diegetic events that are non-overlapping, in those cases in which it is not necessary to distinguish the diegetic interval of occurrence for each event $E1$, $E2$, ... En.

2.6 BELIEFS FROM WHAT CHARACTER SAYS

The spectator's belief that someone is speaking of an event, can be assumed as primitive of my representation – also if it is evident the existence of spectator's preliminary inferential activities (he has to recognize someone talking, understand who is talking to, etc.). The spectator assumes such type of belief because generally he listens to a conversation among characters. For such reason I assumed as primitive the believing that a character Px says that has happened an event Ey to another character Pa:

$$bel(Spx, what(Ex, say(Px, Pa, Ey)))$$

while I proposed for the extradiegetic voice the following representation[31]:

$$bel(Spx, what(Ex, say(extradiegeticVoice, Ey)))$$
$$bel(Spx, who(Ex, extradiegeticVoice))$$

An event Ex that a character Px refers has happened to another character Pa in a story (or what a voice over says has happened), it is not an event explicitly shown on the screen. However starting from the perception regarding what a character said (sometimes applying a filter of credibility to the assertion) the spectator acquires the belief that a determined event has happened (we remember that the spectator's tendency is to believe initially to everything has been brought to his attention on the screen). From the point of view of the representation, many times the event is represented in action form (verb) and temporal interval, but sometimes can be presented also with a nominal group such as a bomb, the television program, the match, and so on. Events are uttered in natural language with a great variety of forms[32]

2.7 EVENTS NOT UTTERED IN THE STORY

In paragraph 1.3 In the paragraph 1.3 I indicated, as part of the activity of reviewing the cognitive state of the viewer, beyond the activity of acquisition of events shown in diegesis and that related to the control of coherence of

31 I have used the notation $bel(Spx, who(Ex, extradiegeticVoice))$, even if the extradiegetic voice is not an entity pertaining to the diegesis – justified by the fact that it is a participant to the event.

32 In these last years in sector of computational linguistic, a formalism denominated TimeML [TimeML]. TimeML is used to annotate events present in a natural language text. TimeML proposes itself as a standard of annotation for many natural languages. See also the formalism OntoTimeFL [Mele2013], that has been proposed as an extension to TimeML formalism.

the cognitive state, also the activity of extending the viewer's beliefs[33]. In these cases the spectator assumes that some events occurred in the story, even if he has never seen them on screen. For example in a movie segment the spectator believes that a killer chases a man (a possible victim), but in the filmic utterance, it is shown only the movement of the dagger and a shadow chasing the victim. The spectator doesn't see the killer to chase the victim – but he believes (he is ready to swear) that there is a killer present in the scene. In this example, the spectator Spx has to possess an inference to permit to acquire the belief:

$$(a)\ bel(spx, what(ex, stalk(murderess, victim)))$$

To arrive to this conclusion the spectator must possess (at a time $t1$) the beliefs:

$$(b)\ mev(t1, bel(spx, what(e1, move(dagger))))$$
$$(c)\ mev(t1, bel(spx, what(e2, stalk(shadow, victim))))$$

then he arrives to the conclusion (a), thanks to a cognitive rule (deductive) of the kind:

$$\begin{aligned} & mev(Tx, bel(Spx, what(Ex, stalk(murderess, victim)))) \leftarrow \\ & \ mev(Tx, bel(spx, what(Ea, move(dagger)))), \\ & \ mev(Tx, bel(spx, what(Eb, stalk(shadow, victim)))), \\ & \ diegeticEvent(Ex), diegeticEvent(Ea), diegeticEvent(Eb). \end{aligned} \tag{2.7.1}$$

In the given example, the beliefs assumptions (b) and (c) are acquired by the principle of perception-belief, while regarding what is not directly shown in the scene (such as the event (a)), a cognitive rule, such as the 2.7.1, is applied by the spectator.

Beliefs extension rules are frequently applied by the spectator during the vision of a movie. A role in a story can be directly uttered (through images or acts of words) and can be inferred by the spectator. If for instance in the story

33 The argument here reported has similarities with another topic studied in the natural language sector named presupposition – about it I give two main bibliographical references [Levinson1983], [Levinson2000] .

is given an event Ex in which a man $P1$ marries a woman $P2$. The event Ex brings to believe into the spectator that $P1$ and $P2$. In this case the following inference is valid:

$$\begin{aligned}
& mev(Tx, bel(Spx, roleEv(E1, rol(husband, Px, Py)))) \quad \leftarrow \\
& \quad mev(Tx, bel(Spx, who(E1, Px))), \\
& \quad mev(Tx, bel(Spx, who(E1, Py))), \\
& \quad mev(Tx, bel(Spx, propEv(E1, prop(genre, Px, male)))), \\
& \quad mev(Tx, bel(Spx, what(E1, marry(Px, Py)))).
\end{aligned} \tag{2.7.2}$$

2.8 TN-TS-TB DIAGRAMS

The narration time of filmic text has a specific peculiarity of being a chronological time. This is due to the fact that the spectator's vision time is different from how it is considered the narration time in literature, that is a false time or pseudo time[34].

In this book I proposed the TN-TS-TB diagrams to represent the **time of narration** on y-axes (indicated with TN), the (diegetic) **time of story** on x-axes (indicated with TS), and the intervals in which spectator's beliefs are valid (**time of beliefs**) on an axis parallel to the one of the narration (indicated with TB). The diagrams TN-TS-TB[35] represent in a graphic form the principle of perception-belief (see section 2.5) in which are plotted the spectator's beliefs in correspondence of every filmic sequence shown on the screen. In figure 2.8.1 I report an example of diagram TN-TS-TB representing a phase of film analysis after the vision of a filmic segment (seqx) *The Killing*, where the spectator believes that Mikei drinks a beer into the bar in the diegetic interval $[tdm, tdn]$.

In the TN-TS-TB diagrams the time axis of the story TS, hasn't obviously the same temporal scale of the narration time TN. It couldn't be different – a movie showing the whole life of a character (60-70 years) or historical periods (100-120 years), are difficult and useless to represent. In figure 2.8.2

34 In [Genette1986] p. 82.

35 The diagrams TN-TS-TB have been introduced in the work [Mele2007] and adopted in following in the construction methodology of multimedia stories, called Semantic Mashup [Mele2010], [Mele2012].

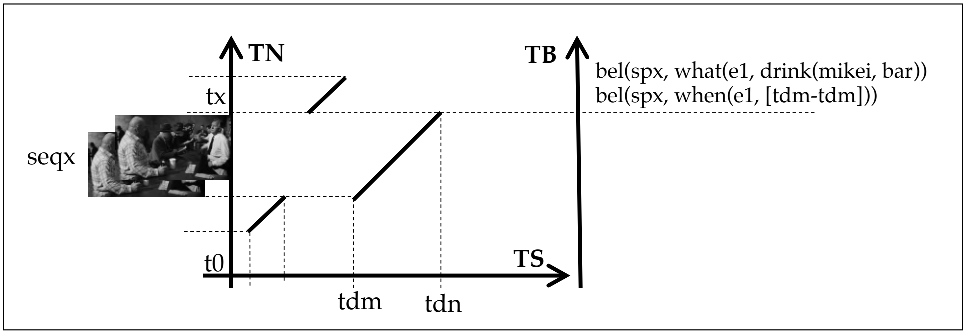


Figure 2.8.1: TN-TS-TB diagram regarding events in *The Killing*

I present another example of TN-TS-TB diagram, where this last aspect is highlighted – in 2.8.2 I consider a brief story in which it is shown the life of a character px through three sequences S1, S2, S3, in which the character px borns in S1, is teenager in S2 and died in S3. The diegetic intervals [td2, td3] and [td4, td5], on the axis of the story TS do not respect graphic proportionality with the narration intervals. In the TN-TS-TB diagrams, while between

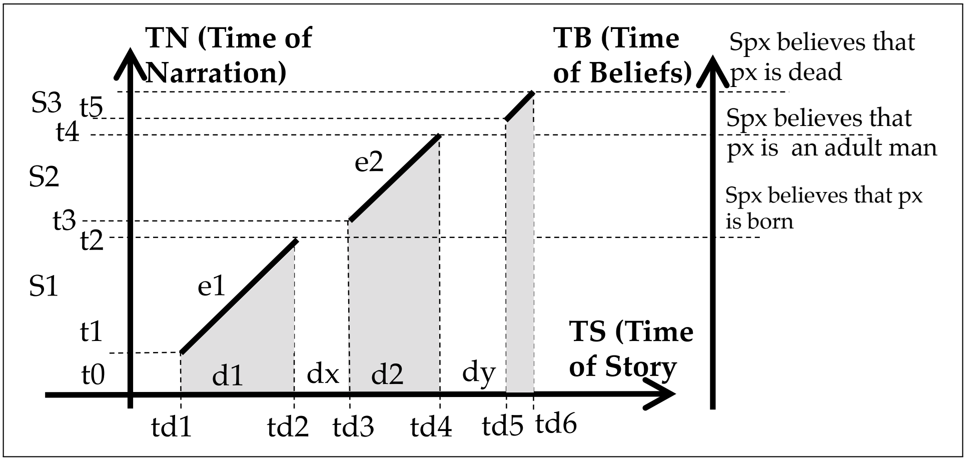


Figure 2.8.2: Example of a simple story represented in a TN-TS-TB diagram

two scenes the proportionality cannot be respected, inside of a same scene a rigorous proportionality exists. This is due to the fact that the narration time is equal to the story time. For this reason such events are represented through segments at 45 grades (argument I will illustrate deeply in next chapter).
The representation in relation to the example shown is the following:

$mev(Tx, bel(Spx, when(e1, [td1, td2])))$
Spx's belief on interval [td1,td2] in which e1 happens;

$mev(Tx, bel(Spx, dur(e1, d1)))$[36] or
$mev(Tx, bel(Spx, dur([td1, td2], d1)))$.
Spx's belief on the duration of event e1

$mev(Tx, bel(Spx, dur([td2, td3], dx)))$
% Spx's belief on the duration dx of interval $[td2, td3]$ – the temporal distance between the events $e1$, $e2$;

$grafScale(dx, 0.03), grafScale(dy, 0.01)$
% The percentages of graphical dilation (or contraction) of the durations dx, dy

To define a temporal metric on the story axis I represent the diegetic instants $td1$,$td2$,…,tdn in this way: $diegeticTime(td1)$, $diegeticTime(td2)$,…, $diegeticTime(tdn)$, $hasValue(td1, v1)$, $hasValue(td2, v2)$, …, $hasValue(tdn, vn)$. With such choice we can define the spectator's beliefs on the diegetic time intervals as follows:

$$\begin{aligned}
&mev(Tx, bel(Spx, dur([Td1, Td2], Dx))) \;\leftarrow \\
&\;mev(Tx, bel(Spx, when(Ex, on([Td1, Td2])))), \\
&\;hasValue(Td1, V1), hasValue(Td2, V2), \\
&\;V2 < V1, Dx = V2 - V1.
\end{aligned} \tag{2.8.1}$$

Through the 2.8.1 the spectator acquires a belief on a diegetic interval in correspondence of an event Ex that happens in the diegesis. We can define

36 In 5.6 I defined the relation $mev(Tx, bel(Spx, dur(Ex, Dx)))$ through the 2.4.5

also a spectator belief for diegetic intervals where an diegetic event does not happen, as follows:

$$
\begin{aligned}
&\mathit{mev}(Tx, bel(Spx, dur([Td2, Td3], Dx))) \leftarrow \\
&\quad \mathit{mev}(Tx, bel(Spx, when(E1, on([Td1, Td2])))), \\
&\quad \mathit{mev}(Tx, bel(Spx, when(E2, on([Td3, Td4])))), \\
&\quad diegeticEvent(E1), diegeticEvent(E2), \\
&\quad diegeticTime(Td1), diegeticTime(Td4), \\
&\quad hasValue(Td2, V2), hasValue(Td3, V3), \\
&\quad hasValue(Td1, V1), hasValue(Td4, V4), \\
&\quad not\ sameE(E1, E2), V2 < V3, Dx = V3 - V2.
\end{aligned} \tag{2.8.2}
$$

Finally, I report the basic inference that leads the spectator to believe that two intervals have the same duration.

$$
\begin{aligned}
&\mathit{mev}(Tx, bel(Spx, sameDur([Td1, Td2], [Td3, Td4]))) \leftarrow \\
&\quad \mathit{mev}(Tx, bel(Spx, dur([Td1, Td2], D))), \\
&\quad \mathit{mev}(Tx, bel(Spx, dur([Td3, Td4], D))), \\
&\quad not\ sameT(Td1, Td3), not\ sameT(Td2, Td4).
\end{aligned} \tag{2.8.3}
$$

2.9 SPECTATOR'S COGNITIVE CHANGES

By taking into account again the sequence regarding Harold shown in paragraph 1.1. In the interval $[t1, t2]$ the spectator sees in the filmic segment $s1$ that Harold has hanged himself. According to the principle of perception-belief from the time $t2$ the spectator believes that Harold has hanged himself. Such mental condition occurs soon after in the narration of the movie (in the interval of vision $[t3, t4]$) as in the sequence $s2$ is shown Harold smiling. In $s2$ the story reveals that the boy shown previously has not hanged himself, but he was joking. The spectator then has to change his own beliefs – in the mental representation, it occurs to eliminate the belief (a) (through the cognitive action (b)) and insert the new belief (c):

(a) $\mathit{mev}(t3, bel(Spx, what(e1, be\_hanged(harold))))$.
(b) $\mathit{mev}(t4, remBel(spx, what(e1, be\_hanged(harold))))$.
(c) $\mathit{mev}(t4, addBel(spx, what(e2, joke(Harold))))$.

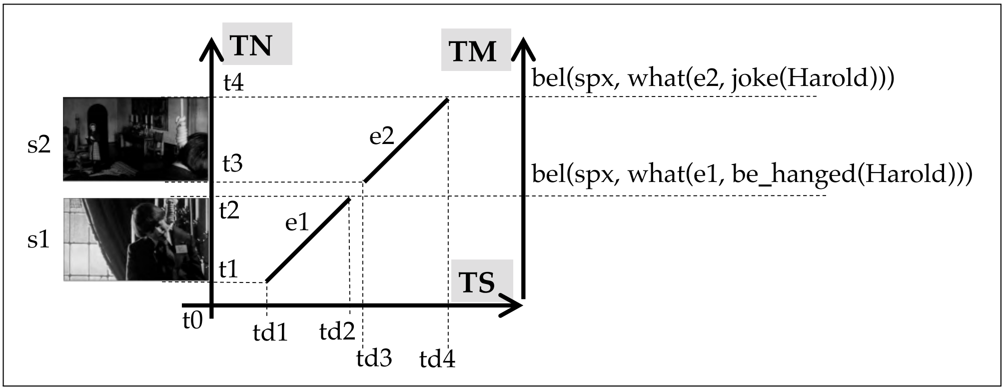


Figure 2.9.1: Cognitive change of beliefs – an example

The example shows how the belief is an adequate notion to represent the spectator's cognitive state, with his change over time.

2.10 SPECTATOR'S TEMPORAL ANCHORING – A COGNITIVE AFFAIR

After having recognized an event Ex inside of the filmic segment $segx$ and after that the spectator has acquired the relative beliefs, what does it mean that the spectator does a temporal anchoring of Ex? Concerning the spectator, the anchoring of a story event Ex consists in finding a temporal order relation between Ex with at least another event En already seen (believed happen) in the story. The spectator's common sense reasoning (acquired by his experience in the real world) pushes him to collocate Ex in three possible positions with respect to an event En[37]:

$$prec(Ex, En),\ prec(En, Ex),\ over(En, Ex).$$

The temporal anchoring of an event on the axis of the story, is the result of a cognitive action of the spectator. For this reason it has to be represented by a

37 The expression corresponds to a fundamental concept denominated Time's Arrow, represented as axiom in a formalism by B. Russel & H. Kramp (a first formalization was due to Russell [Russel1936] and it was later echoed by Kramp [Kramp1979]).

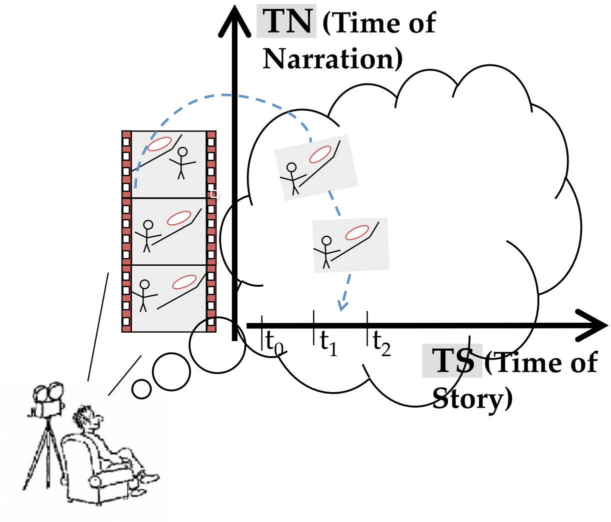


Figure 2.10.1: The cognitive action of the spectator for the temporal anchoring

belief. This not only because it is a mental activity, but also because believing that an event Ex happens before, after or during another event En, it is a dynamic knowledge – that can change over time in the spectator, when the narration goes on. As anticipated in paragraph 2.3, a belief that regards a temporal order between events constitutes an hypothesis in the spectator's mind can change over time, in the same manner in which the spectator changes idea about the events happened in the story, for instance when he believes that a character Px is died and successively Px in the story is shown alive. I represent the spectator's beliefs on the temporal order relations, such as:

$$mev(Tx, bel(Spx, prec(E1, E2))).$$

- at time Tx the spectator Spx believes $\mathsf{E1}$ precedes $\mathsf{E2}$ in the story[38]. For an event Ex that is shown in the story, the spectator with respect to another story event En has three possible choices[39]:

$$\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{Ex}, \mathsf{En}))).$$
$$\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{En}, \mathsf{Ex}))).$$
$$\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{over}(\mathsf{En}, \mathsf{Ex}))).$$

It is to observe that not always the spectator is able to anchor an event Ex. It can happen, not for lack of spectator's reasoning abilities, but simply because the story, until that moment, hasn't reported the knowledge needed. This does not imply that the event will be never anchored. As always happens the story will give knowledge to anchoring the event later in the narration.

We can represent standard figures of anchoring, as the flashback and the flashforward, through spectator's beliefs on the temporal order of events, by utilizing the TN-TS-TB diagrams. In figure 2.10.2 I report an example of such representations. The example regards four sequences – $\mathsf{sq1}$, $\mathsf{sq2}$, $\mathsf{sq3}$ and $\mathsf{sq4}$ – containing six diegetic events $\mathsf{e1}, ..., \mathsf{e6}$, in correspondence of these events on TB axis are given the beliefs of a spectator spx regarding the temporal order of the events (for example at time $\mathsf{t4}$, $\mathsf{bel}(\mathsf{spx}, \mathsf{prec}(\mathsf{e3}, \mathsf{e4})))$) and the spectator's beliefs on flashbacks and flashforwards happened in a story. I also report in the diagram a particular temporal anchoring, that I will discuss in the chapter 5, regarding the repetition of an event $\mathsf{e2}$, $\mathsf{e6}$, that as I will show, brings to the conclusion that $\mathsf{e2}$ and $\mathsf{e6}$ happen on the same interval. Lastly as we can see from the diagram, all beliefs are generated after each vision to sequences ($\mathsf{sq1}$, $\mathsf{sq2}$, $\mathsf{sq3}$ and $\mathsf{sq4}$), in according with the discrete model of spectator's mental state revision, introduced in figure 1.3.1, paragraph 1.3.

38 Sometimes in an equivalent manner we represent the anchoring with a relation of temporal order as:

$$\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}([\mathsf{Td1}, \mathsf{Td2}], [\mathsf{Td3}, \mathsf{Td4}]).$$

where $[\mathsf{Td1}, \mathsf{Td2}]$ and $[\mathsf{Td3}, \mathsf{Td4}]$ are the diegetic intervals of two story events.

39 In this discussion I consider the relation $\mathsf{eq}(\mathsf{En}, \mathsf{Ex})$ as particular case of $\mathsf{over}(\mathsf{En}, \mathsf{Ex})$)).

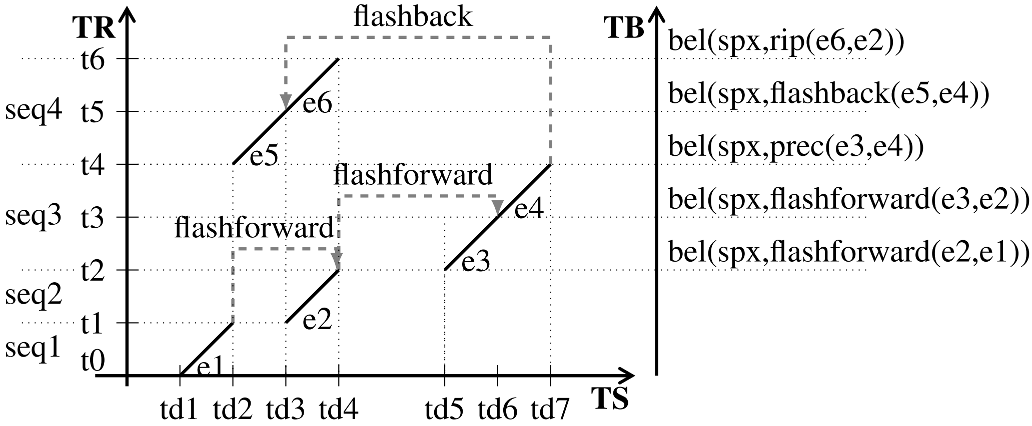


Figure 2.10.2: Temporal anchorings represented through TN -TS -TB diagrams

2.11 MAIN INFERENCES FOR SPECTATOR'S TEMPORAL ANCHORING

In this book for representing spectator's cognitive rules, I used a formalism defined in the style of the DLV language[40].

The entire axiomatic that I have proposed for temporal reasoning of the viewer has been reported in the section 12.2, I give some basic rules[41].

40 DLV is a deductive database system, based on disjunctive logic programming, which offers front-ends to several advanced KR formalisms. It has been conceived by an Italian-Austrian research team (of the University of Calabria and the Vienna University of Technology). For the syntactical correctness of the DVL formulas contained in this book I used ASPIDE SYSTEM [ASPIDE]

41 Such axiomatic is given in a function of relation $over(E1, E2)$ – using a representation more general reported in this paragraph (in function of relation $eq(E1, E2)$:

$$mev(Tx, bel(Spx, over(E1, E2))) \leftarrow mev(Tx, bel(Spx, eq(E1, E2)))$$

First rule: the spectator Spx believes that the event $E1$ precedes $E3$ if Spx believes that an event $E1$ precedes an event $E2$ and believes that $E2$ happens in the same temporal interval of another event $E3$. Formally:

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E3))) \leftarrow\\&\quad mev(Tx, bel(Spx, prec(E1, E2))),\\&\quad mev(Tx, bel(Spx, eq(E2, E3))).\end{aligned} \tag{2.11.1}$$

Second rule: the spectator Spx believes that the event $E1$ precedes $E3$ if Spx believes that the event $E1$ precedes $E2$ and that $E2$ precedes $E3$. Formally:

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E3))) \leftarrow\\&\quad mev(Tx, bel(Spx, prec(E1, E2))),\\&\quad mev(Tx, bel(Spx, prec(E2, E3))).\end{aligned} \tag{2.11.2}$$

This inference constitutes the transitivity of the temporal precedence relations from a cognitive point of view.

Third rule: the spectator Spx believes that $E2$ does not precede $E1$ if Spx believes that an event $E1$ precedes $E2$. Formally:

$$\begin{aligned}&mev(Tx, bel(Spx, \neg prec(E2, E1))) \leftarrow\\&mev(Tx, bel(Spx, prec(E1, E2))).\end{aligned}$$

I have represented, the previous expression as a constraint, in the form:

$$\begin{aligned}\leftarrow\ & mev(Tx, bel(Spx, prec(E2, E1))),\\& mev(Tx, bel(Spx, prec(E1, E2))).\end{aligned} \tag{2.11.3}$$

Fourth rule: the spectator Spx believes that $E2$ does not happens on the same temporal interval $E2$ if Spx believes that an event $E1$ precedes an interval $E2$.

$$\begin{aligned}&mev(Tx, bel(Spx, \neg eq(E1, E2)))) \leftarrow\\&\quad mev(Tx, bel(Spx, prec(E1, E2))).\end{aligned}$$

Also such rule have been represented constraint:

$$\begin{aligned}\leftarrow\ & mev(Tx, bel(Spx, over(E1, E2))),\\& mev(Tx, bel(Spx, prec(E1, E2))).\end{aligned} \tag{2.11.4}$$

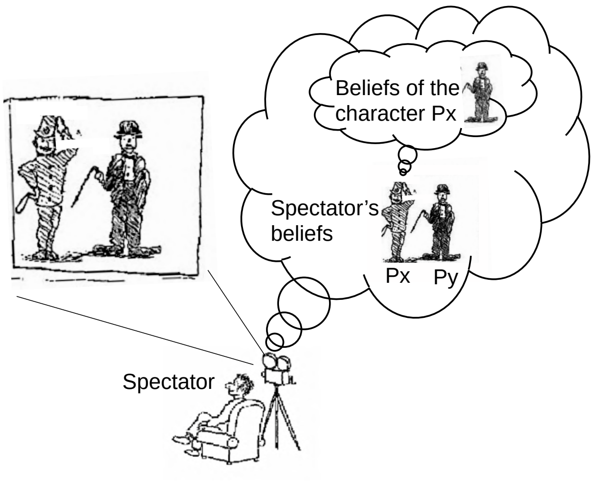


Figure 2.12.1: Internal characters' beliefs

It exists a fundamental rule (already mentioned previously) that joins the causation between two events with their temporal order: a spectator Spx believes that $E1$ precedes $E2$ if Spx believes that an event $E1$ causes another event $E2$. Formally:

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E2))) \quad \leftarrow\\ &\; mev(Tx, bel(Spx, E1)),\\ &\; mev(Tx, bel(Spx, E2)),\\ &\; mev(Tx, bel(Spx, cause(E1, E2)))\end{aligned}$$

(about this cognitive inference I will discuss later in this book).

2.12 BELIEFS, DESIRES AND INTENTIONS OF STORY CHARACTERS

Spectator's beliefs regarding characters' beliefs (or others mental attitudes), are very important to comprehend and justify the characters' actions inside of a story. The spectator Spx comprehends the causal nexus among events interesting a determined character Px, because he makes suppositions (right or wrong that can be) regarding beliefs, desires, intentions or generally character's feelings. These last many times are deductible from the behaviour (actions, words, facial expressions, ecc.) of the characters themselves.

Knowing character's cognitive state is very important to understand the causality of some events and so to determine the temporal order of the events.

It arises a question about how the spectator attributes cognitive state to the characters. As the spectator Spx has not tools to read in the mind of a character (nor him, nor other person really can). Spx starts from events happened in the diegesis $E1$, $E2$, .., En perceived in direct modality (without mediation of characters) in correspondence of them Spx generates beliefs of the kind $bel(Spx, E1)$, $bel(Spx, E2)$,..,$bel(Spx, En)$. Starting by these beliefs, Spx makes assumption of beliefs on character's cognitive state in the form:

	% Spx believes that the character:
$mev(Tx, bel(Spx, bel(Px, Ex)));$	% Px believes that Ex happens;
$mev(Tx, bel(Spx, int(Px, Ex)));$	% has the intention to cause Ex;
$mev(Tx, bel(Spx, goal(Px, Ex)));$	% has the goal that Ex happens;
$mev(Tx, bel(Spx, bel(Px, cause(E1, E2)))).$	% believes that $E1$ causes $E2$.

A basic inference that leads to the generation of spectator's beliefs about characters' beliefs, is the following:

$$
\begin{array}{lcl}
 & & \text{\% } Spx \text{ believes that } Px \text{ believes} \\
mev(Tx, bel(Spx, bel(Px, Ex))) & \leftarrow & \text{\% that } Ex \text{ is happened, if} \\
\quad mev(Tx, bel(Spx, see(Px, Ex))). & & \text{\% } Spx \text{ believes that } Px \text{ sees } Ex.
\end{array} \tag{2.12.1}
$$

if Spx believes that Px has seen Ex then Spx believes that Px believes Ex has happened.

The principle of perception-belief is not only a substitution of "a knowledge" with "a belief", but also a proposal of defining what the filmic text shows and what the spectator believes to see.

In a first step we need build belief rules in relation to what is shown on the screen, without any other suppositions (beliefs) upon what the story characters "have perceived" or believed. In a second step then I have to explore on the characters' cognitive state (goals, intentions). I report in this book (chapter 6) a fairly comprehensive analysis of these phenomena (called ocularizations). These last constitute the cognitive processes inference leading the spectator to assume beliefs on spectator's internal cognitive states (beliefs, goals, intentions).

2.13 COGNITIVE ASPECTS OF EVENTS - A REPRESENTATION

Taking in consideration Block's classification, the events[42] can be analyzed and represented through three aspects:

a- event as an element of a succession of temporal entities
b- event as duration
c- event as a temporal perspective

In my approach of analysis, I consider spectator's beliefs on diegetic times which are related to the times of story events. I adopt for the diegetic times the following representation:

$$diegeticTime(td1); diegeticTime(td2); \dots; diegeticTime(tdn)$$

Events such as diegetic successions, are a natural representations for stories, where each temporal order relationship must be associated to a causal relationship of type: $bel(spx, cause(ex, ey))$

$bel(spx, when(e1, on([td1, td2])))$.
$bel(spx, when(e2, on([td3, td4])))$.
$bel(spx, when(e3, on([td5, td6])))$.
$bel(Spx, prec([td1, td2], [td3, td4]))$.
$bel(spx, prec([td3, td4], [td5, td6]))$.
or also other representation as
$bel(spx, prec(e1, e2))$.
$bel(spx, prec(e2, e3))$.

42 See the note reported in paragraph 5.6 about the article of Block R. [Block1990]

Event as diegetic duration. The belief's spectator about event diegetic duration is a useful concept for analyzing the relationships among narration times and story times, it can be defined through the occurrence interval of Ex:

$$\begin{aligned}
&\mathsf{bel}(\mathsf{Spx}, \mathsf{dur}(\mathsf{Ex}, \mathsf{Dx})) \ \leftarrow \\
&\ \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ex}, \mathsf{on}([\mathsf{Td1}, \mathsf{Td2}]))), \\
&\ \mathsf{diegeticTime}(\mathsf{Td1}), \\
&\ \mathsf{diegeticTime}(\mathsf{Td2}), \\
&\ \mathsf{Dx} = \mathsf{Td2} - \mathsf{Td1}.
\end{aligned} \tag{2.13.1}$$

It is also useful to consider the belief about the duration of an event, with respect to a story character Px:

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Px}, \mathsf{when}(\mathsf{Ex}, \mathsf{on}([\mathsf{Td1}, \mathsf{Td2}])))) \tag{2.13.2}$$

We can use the expression 2.13.2 for defining the spectator's beliefs on the durations perceived by characters about story event intervals:

$$\begin{aligned}
&\mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Px}, \mathsf{dur}(\mathsf{Ex}, \mathsf{Dx}))) \ \leftarrow \\
&\ \mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Px}, \mathsf{when}(\mathsf{Ex}, \mathsf{on}([\mathsf{Td1}, \mathsf{Td2}])))), \\
&\ \mathsf{diegeticTime}(\mathsf{Td1}), \ \ \mathsf{diegeticTime}(\mathsf{Td2}), \ \ \mathsf{Dx} = \mathsf{Td2} - \mathsf{Td1}.
\end{aligned} \tag{2.13.3}$$

This notion is useful to represent *Personal Time*, a concept present in stories where for a certain character the time flows differently from other characters, and where the viewer *perceives* this difference.

Another useful concept is the one related to the spectator's belief on the comparison of the duration of an event with another event:

$$\begin{aligned}
&\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{sameDurI}(\mathsf{E1}, \mathsf{E2}))) \ \leftarrow \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{dur}(\mathsf{E1}, \mathsf{D1}))), \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{dur}(\mathsf{E2}, \mathsf{D2}))), \\
&\ \mathsf{D1} = \mathsf{D2}, \mathsf{E1}! = \mathsf{E2}.
\end{aligned}$$

Event as diegetic prospective. The key concept for this type of event aspect is the following:

$$\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{nowTd}(Tdx))) \tag{2.13.4}$$

The meaning of 2.13.4 is the following: for each narration time Tx the spectator Spx believes that the diegetic current time is Tdx.Through this definition we can define in formal way the note axiom ”the movie is at present time":

$$\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{sameT}(Te, Tdx))) \leftarrow \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{te}(Ex, Te))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{nowTd}(Tdx))), \\
&\quad \mathit{diegeticTime}(Ex).
\end{aligned}$$

where Te (the enunciation time) in $\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{te}(Ex, Te)))$ represents the diegetic time in which the event Ex is shown in the story (see paragraph 4.4 in the chapter 4).

I represent an event believed to happen in a diegetic past time in the following way:

$$\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{inPastTime}(Ex))) \leftarrow \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{when}(Ex, \mathit{on}([Td1, Td2]), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{now}(Tdx))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{prec}(Td2, Tdx))), \\
&\quad \mathit{diegeticTime}(Td1), \mathit{diegeticTime}(Td2), \mathit{diegeticTime}(Tdx).
\end{aligned} \tag{2.13.5}$$

and a spectator's belief about a diegetic future time as:

$$\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{inFutureTime}(Ex))) \leftarrow \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{when}(Ex, \mathit{on}([Td1, Td2]), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{now}(Tdx))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{prec}(Tdx, Td1))), \\
&\quad \mathit{diegeticTime}(Td1), \mathit{diegeticTime}(Td2), \mathit{diegeticTime}(Tdx).
\end{aligned} \tag{2.13.6}$$

Regarding the revision process we can suppose to happen through discrete intervals, and is revised to each act of vision

$$
\begin{aligned}
&mev(T2, addBel(Spx, now(Td1))) \leftarrow \\
&\ visAct([T1, T2], Spx, Segx, [Td1, Td2], Ex).
\end{aligned}
$$

$$
\begin{aligned}
&mev(T2, remBel(Spx, now(Tdx))) \leftarrow \\
&\ visAct([T1, T2], Spx, Segx, [Td1, Td2], Ex) \\
&\ Tdx! = Td1, \\
&\ Tdx! = Td2.
\end{aligned}
$$

Finally, through the expression:

$$mev(Tx, bel(Spx, bel(Px, nowTd(Tdy)))) \tag{2.13.7}$$

we can also consider temporal perspective of the characters. It is a concept of personal time that regards the present time in which a character lives. The example that we report is present in the film *The Lake House*, where a character believes to live his present in a postponed time to that of another character. Obviously, the time Tdy in the 2.13.7 must be represented as a diegetic chronological time.

All definitions of this paragraph have been affected by the need to build a model for the basic temporal entities represented in the mind of the spectator. So I had to make abstractions, separate inseparable entities, and reduce concepts that appeared irreducible – in other words I have simplified and very much (more than any other simplification I have made in this book) – but I convinced that the concepts presented are in tightly correspondence with the basic ones that the spectator uses, in temporal reasoning regarding a movie story.

Part II

Story and narration – a cognitive approach

3 NARRATION TIME AND STORY TIME – A COGNITIVE APPROACH

The relationships between narration time (TN) and story time (TS) have been analyzed and theorized by G. Genette in an elegant pioneering work[1]. The theory of the French semiologist has been accepted by everyone as a conceptual basis of reference and every successive formulation about this topic has been inspired from it.

G. Genette has conceived his theory by starting from an analysis material of the literary narrative and, although in his work there are many references to the filmic text, his theory, about the relationships between time of narration and time of story, has remained anchored and confined to the written tale. It could not be otherwise – the filmic telling has many peculiarities that raise new fields of survey, whose theoretical results are and will be always different from the literary narration.

Among the greater differences, it emerges that the narration time of a movie is chronological – the end of the narration corresponds to the viewing time of the movie – for a written text, instead, it does not exist or it is a fictitious time (we can consider it in a fictitious way).

Furthermore in a movie there are some forms of narration participating in a same discourse, that is to say in the same time of narration you can overlap more diegetic units – images, videos, music, noise and voice (in the field and voice over).

All parts of the filmic text (each one having a specific meaning) can be separately analysed, together to the relations existing among them and the contribution that singly give to the entire movie.

Sound, colour, nature of the actions, effects of slowing down and image acceleration, as well as the voice intonation and the kind of sound – are factors

1 The relations between TN and TS have been presented by G. Genette in his work [Genette1986] p. 135.

present in the filmic text (not in that written), that contribute both to the story and to the way in which this last is staged.

In this chapter I analyze – in cognitive terms – the relationships between narration time and story time in a movie, by using the modeling tools of the spectator's beliefs on story events. I in addition report some theoretical hypotheses about how the spectator *lives a cognitive time*, in a separate way from the chronological and diegetic time.

Eventually, in this chapter, I report some models representing spectator's expectations arising from particular interruptions of the story (ellipsis) – topic that I will resume in the chapters where I will discuss about the fitting of the story after relative breaks.

3.1 SPEED OF DIEGETIC EVENTS AND NARRATION TIME

Generally when in a scene the spectator sees a falling ball, an Indian shooting an arrow, a man shooting cowboy rolling down the stairs,. . . , he (always) performs a comparison (qualitative) between the duration of the diegetic event, shown on the screen, with the duration of an event (of the same kind) that has registered into his *mental database* (built by the experience of the real life) where every action has its typical duration. When this temporal equality is not respected, the spectator makes inferences at starting from what is being viewed on the screen: an action that is reported more slowly compared to the his typical time, activates mechanisms of greater attention; an action that is reported instead with a slower duration than the actual, brings the spectator to believe that the correspondent event is unimportant for the story.

The confront between the speeds of the diegetic and real events, is then a cognitive activity of the spectator. In the next paragraph I discuss of the events speed and how these latter characterize some figures of narration.

TYPICAL DURATION OF AN EVENT. When a diegetic action (and hence a diegetic event) is shown with a slowdown of the images, the spectator perceives such slowdown, as he has in mind the reference time of the correspondent typical event. Figure 3.1.1 shows an event Ex with a duration

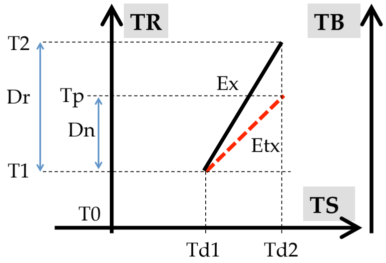


Figure 3.1.1: Typical events and diegetic events

Dr greater than the corresponding duration Dn of the typical event Etx. I make the assumption that viewer Spx believes that in the story the diegetic interval in which the event Ex happens is $[Td1, Td2]$, and that Spx performs the confront of the durations "$Dr < Dn$, $Dr = Dn$" and "$Dn = Dr$" on the narration axis. In order to represent the relationships among typical and diegetic events, I propose the following formalism:
$mev(Tx, bel(Spx, dur(Ex, Dx)))$
% spectator believes that the diegetic event $[Ex]$ has duration Dx

$mev(Tx, bel(Spx, dur([Td1, Td2], Dx)))$
% spectator believes that the diegetic interval $[Td1, Td2]$ has duration Dx
% (this definition has been reported in 3.1.2)

$mev(Tx, bel(Spx, typicalDur(Ex, Dn)))$
% spectator's belief about typical duration of an event Ex.

$mev(Tx, bel(Spx, less(Dn, Dr)))$
% spectator believes that the duration Dn of Etx is less than duration Dn of Ex
% (specific slowdown case reported in figure 3.1.1).

SINGLE ORDINARY EVENTS. In cognitive terms the spectator believes that a single ordinary event has happened, when he observes a segment of a movie without any cuts or stops of the camera shooting, and when he does not observe nor a slowdown slow motion, or an acceleration of im-

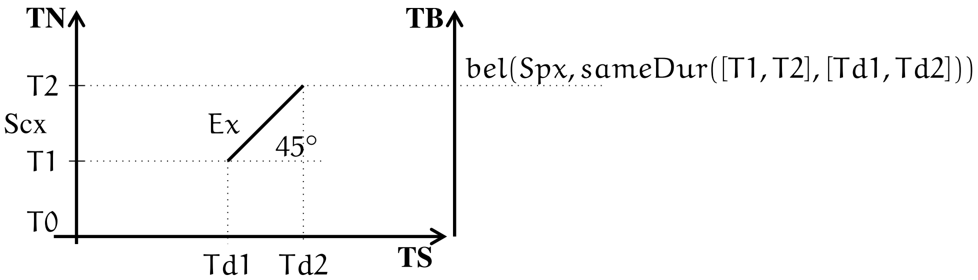


Figure 3.1.2: Speed of a single ordinary event

ages – when this happens the narration time is the same of the story time ($sameDur([T1, T2], [Td1, Td2])$) – see figure 3.1.2.

$$\begin{aligned}
&mev(Tx, bel(Spx, singleOrdinaryEvent([T1, T2], [Td1, Td2]))) \leftarrow\\
&\quad visAct([T1, T2], Spx, Segx, [Td1, Td2], Ex),\\
&\quad prec(T2, Tx),\\
&\quad mev(Tx, bel(Spx, noCut([Td1, Td2]))),\\
&\quad mev(Tx, bel(Spx, dur([T1, T2], Dp))),\\
&\quad mev(Tx, bel(Spx, typicalDur(Ex, Dp))),\\
&\quad time(Tx), time(T1), time(T2).
\end{aligned} \tag{3.1.1}$$

$$\begin{aligned}
&mev(Tx, bel(Spx, sameDur([T1, T2], [Td1, Td2]))) \leftarrow\\
&\quad visAct([T1, T2], Spx, Segx, [Td1, Td2], Ex),\\
&\quad mev(Tx, bel(Spx, singleOrdinaryEvent([T1, T2], [Td1, Td2]))),\\
&\quad diegeticEvent(Ex), diegeticSegment(Segx).
\end{aligned} \tag{3.1.2}$$

PAUSE. A temporary lack of actions, associated with the characters of a story, is generally called *pause* (see diagram of representation in figure 3.1.3). If, for example, in the filmic segment there is a digression of image descriptions related to geographical spaces, these constitute a pause in the story.

I believe in an analysis with cognitive approach, the writing ”TS=0” must be understood as a symbol denoting only an absence of significant events in the story, but cannot certainly denote a null duration of the diegetic interval.

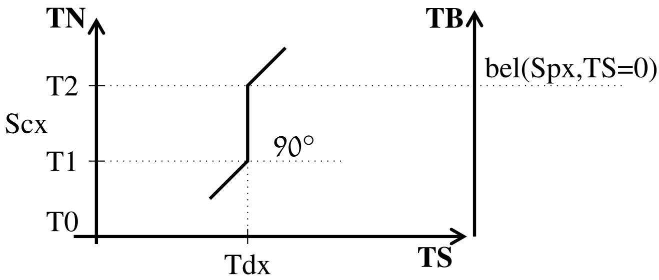


Figure 3.1.3: Pause or Time Slice represented by a TN-TS-TB diagram (TN=N, TS=0)

The initial sequences of *Chocolat*, the travelling of the camera begins from the clouds and *dives* on the door of the church in the country, or the flight of Karin (M. Streep) and Denys (R. Redford) on the beach of pink flamingos in *Out of Africa*, are examples of filmic segments that, in a classic analysis of the movie, are labelled as pauses (that is, as a lack of story actions). Instead in a cognitive analysis, spectator's mental state continues to accumulate sensations – the images that are transmitted him, the colors and shapes increase the emotions in this latter. Although such narrative forms (in a classic interpretation) are considered pauses, they are not cognitive pauses. The spectator's cognitive state generally changes from the instant in which the story stops itself (in 3.1.3 at time T1) for lack of events, to when it starts again (at time T2). The diagram of figure 3.1.3 is also suitable to represent the narrative figure by **Time-Slice** – where in this case the story time is null ($\triangle$TS=0). Through this technique all actions stop in a frame, and restart from the same spatial and temporal coordinates – what is shown to the spectator in a zero time interval of the story ($\triangle$TS=0), are spaces and characters filmed from different points of view. Also in this case, despite diegetic time is null, in the spectator's cognitive space there is an increase beliefs on sounds and images, and the mental time (TB) does not undergo pauses.

EXPANSION. An expansion happens when the time of narration is greater than the time of story ($\triangle TN > \triangle TS$). This condition is achieved when an action is shown in slow motion (angle of segment representing an event greater than 45 degrees), where the diegetic time for the spectator passes more slowly than that of the telling. An expansion can be accomplished in a single

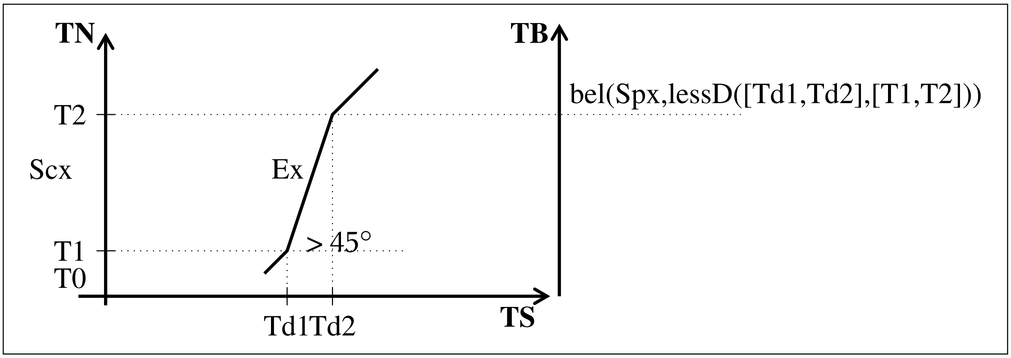


Figure 3.1.4: Slow Motion represented by a TN-TS-TB diagram (TN >TS)

scene or in a group of contiguous scenes – a slowdown example of this kind is presented in many movies. I take as example a sequence in the movie *The Untouchables*, when the stroller with a child inside slowly descends a staircase. Another known example of slowed sequence, is present in the final of the movie *Twelve Monkeys*, when the protagonist of the story James Cole (Bruce Willis) is hit by the bullets of the police at the airport before boarding. The scene of the back shots to Cole, the scream of his partner Kathryn Railly (Madeleine Stowe) and the gaze of the child (which is Cole as a child) are represented all with slow motion – there is an extradiegetic music linking scenes in one unit – built with a slow rhythm for emphasizing the expansion.,

EXPANSION FOR REPETITIONS. An expansion happens even when one or more events are repeated – one or more times – in consecutive sequences. In this case it does not matter if the sequence is repeated from different points of view (see figure 3.1.5). From a cognitive point of view the effect of events repetition in consecutive sequences, it is to generate an expansion of narration time – that is said in an incisive way in [Rondolino2011].

> In *October* Ejzenstenjn, . . . , shows us another device determining an effect of extension: the repetition in the narration of a certain event that happens only once in the story. The opening of the door communicating with the throne room of the zar, is repeated in fact, several times, through a succession of different images that from various points of view show us the same event: in this way the narration time is made longer than that of the story

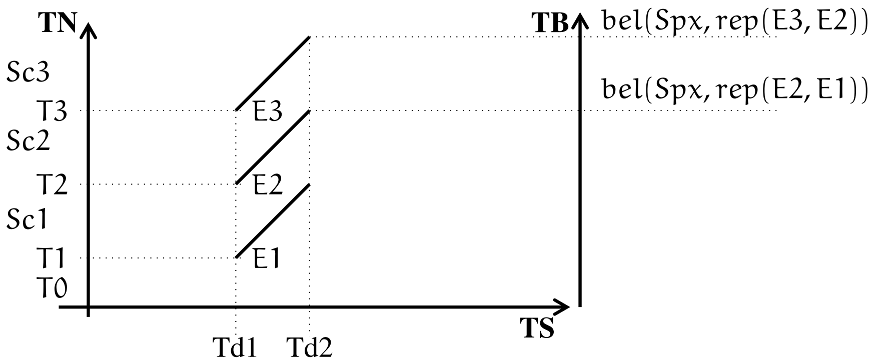


Figure 3.1.5: Expansion for repetition of events represented by a TN-TS-TB diagram ($\triangle$TS< $\triangle$ TN)

An example of expansion for repetition is present in *American Beauty* [AmericanBeauty]. In this case Lester Burnham's hand (Kevin Spacey) moves three times, in slow motion, towards the body of a girl – Angela Hayes (Mena Suvari) – such repetition becomes a tool of staging to emphasize the intensity of Lester's desire to caress the girl.

A particular case of expansion is Fernandez's goal (character played by Pelé) in the movie *Victory*, staged through three sequences $sc1$, $sc2$ and $sc3$ (see figure 3.1.6). In the sequence $sc1$ in the event $e1$ Fernandez's spectacular overhead kick is reported in slow motion. In the event $e2$, without time slowed, it is shown the ball into the net. In the following sequence $sc2$, there is an event $e3$ which is a repetition of $e1$. In the third sequence is $sc3$ presented in $e4$, always in slow motion, a repetition of the events $e1$ and $e3$ – the sequence $sc3$ continues with the beat of the hands (not in slow motion) of the German officer who claps to Fernandez's goal. In this example the axis of the narration thus undergoes a double expansion – the events $e1$, $e2$ and $e3$, besides being repeated, are also expanded on the axis of the story through some slowdowns.

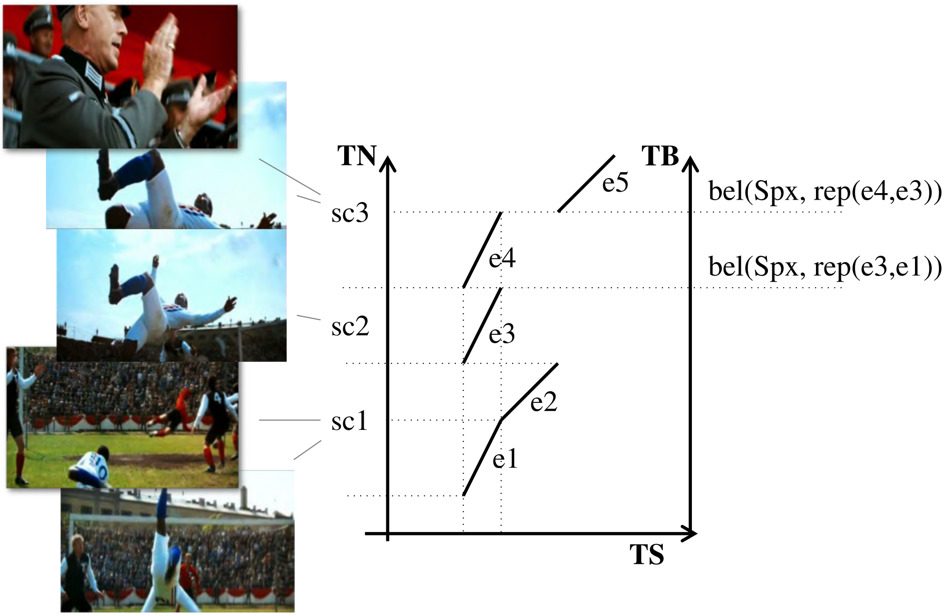


Figure 3.1.6: Double expansion in *Victory*

3.2 EVENTS BELONGING TO A SAME SCENE

In cognitive terms, a ordinary scene (sceneOrd) can be defined as a narrative form in which the spectator observes a film segment, containing accomplished events, without detecting cuts while watching it, and without slowdowns of the events that compose it:

$$\begin{aligned}
&mev(Tn, bel(Spx, sceneOrd([T1, Tn], [E1, E2, En]))) \quad \leftarrow \\
&\; visActE([T1, T2], Spx, Seg1, [Td1, Td2], E1), \\
&\; visActE([T3, T4], Spx, Seg2, [Td3, Td4], E2), \\
&\; visActE([Tm, Tn], Spx, Segn, [Tdm, Tdn], En), \\
&\; prec(T2, T3), prec(T4, Tm), \\
&\; mev(T4, bel(Spx, sameDur([T1, T2], [Td1, Td2]), \quad \text{\%} \\
&\; mev(T4, bel(Spx, sameDur([T3, T4], [Td3, Td4]), \quad \text{\% No} \\
&\; mev(T4, bel(Spx, sameDur([Tm, Tn], [Tdm, Tdn]). \text{ \% slowdowns} \\
\\
&\; mev(T4, bel(Spx, noCut(Td2, Td3))), \quad \text{\% No} \\
&\; mev(Tn, bel(Spx, noCut(Td4, Tdm))), \quad \text{\% cuts} \\
&\; diegeticSegment(Seg1), diegeticSegment(Seg2), \\
&\; diegeticSegment(Segn).
\end{aligned} \tag{3.2.1}$$

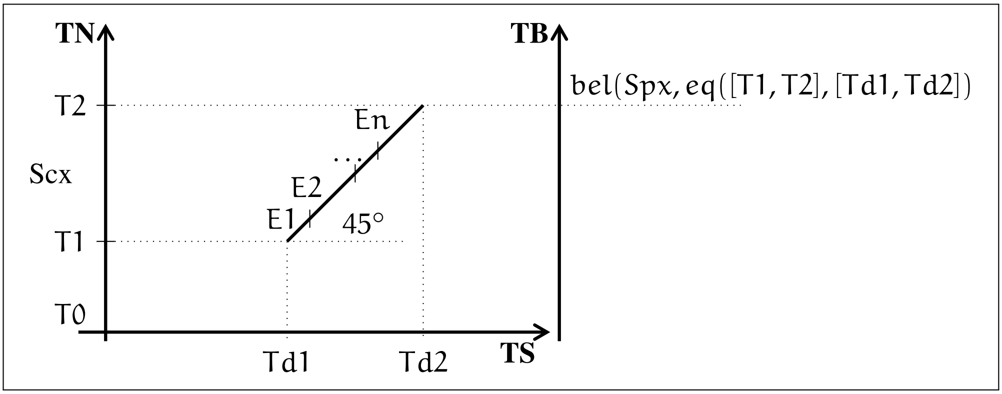


Figure 3.2.1: Ordinary scene represented by a TN-TS-TB diagram ($\triangle$TN= $\triangle$ TS)

When an ordinary scene occurs, the spectator believes that the interval $[Td1, Tdn]$ of events $E1$, $E2$, and En belonging to an ordinary scene and the interval $[T1, Tn]$ of the entire filmic segment $Seg1$, $Seg2$,..., and $Segn$, have the same duration.

$$\begin{array}{l} mev(Tx, bel(Spx, sameDur([T1, Tn], [Td1, Tdn]))) \leftarrow \\ visAct([T1, T2], Spx, Seg1, [Td1, Td2], E1), \\ visAct([T3, T4], Spx, Seg2, [Td3, Td4], E2), \\ visAct([Tm, Tn], Spx, Segn, [Tdm, Tdn], En), \\ Tn < Tx, \\ mev(Tx, bel(Spx, sceneOrd([T1, Tn], [E1, E2, En]))). \end{array} \tag{3.2.2}$$

In an ordinary scene (see figure 3.2.1) there is a direct proportionality (at 45 degrees) between the interval of vision $[Td1, Td2]$ and the diegetic interval $[Td1, Td2]$ on which the events happen (see figure 3.2.1). I assumed that for every new filmic segment, for which the spectator selects one, or more than one, significant story event, the latter have among them a various type of relations.

If the spectator believes that two events Ex and Ey happen in correspondence to two filmic segments $Seg1$ and $Seg2$, shown in the time of narration $[T1, T2]$ and $[T3, T4]$ respectively, and in the interval $[T1, T4]$, where there are no cuts (the events belong to the same scene), then the spectator believes that Ex precedes Ey. This occurs because the spectator sees a continuos stream of images, where there are not interruptions between the filmic segments $Seg1$ and $Seg2$. The rule has a certain plausibility because is the same inference that the spectator performs in real life, where while he observes (without interruptions in the vision), one event after the other and assumes the temporal sequentiality of the same. I report the cognitive rule just described: Spx believes that Ex precedes Ey if: the vision acts of filmic segments $Seg1$, $Seg2$ happen; $Seg1$, $Seg2$ are sequential; the time of belief is Tx, and Spx believes that Ex and Ey are visually contiguous[2].

$$
\begin{array}{ll}
mev(Tx, bel(Spx, prec(Ex, Ey))) \leftarrow & \\
\quad visAct([T1, T2], Spx, Seg1, [Td1, Td2], Ex), & \\
\quad visAct([T3, T4], Spx, Seg2, [Td3, Td4], Ey), & \\
\quad mev(Tx, bel(Spx, noCut(Td2, Td3))) & \\
\quad mev(Tx, bel(Spx, prec(T2, T3))) & \text{% Spx believes that T2 precedes T3} \\
\quad prec(T4, Tx), & \text{% Tx is the time of belief} \\
\quad mev(Tx, bel(Spx, visContiguous(Ey, Ex))). &
\end{array}
\tag{3.2.4}
$$

Ultimately then, if the spectator Spx in two acts of vision acquires the beliefs on the events Ex and Ey, observed in two consecutive sequences in the narration $Seg1$ and $Seg2$, and believes that the scene is continuous, then Spx believes that the event Ex precedes Ey.

The rule 3.2.4, which I have called rule of **diegetic sequentiality of events by default**(see in figure 3.6.7 case $A6$), plays a key role in relations between the time of narration and time of story – it is used a large number of times in a movie, almost always without the spectator's awareness. The rule is applied only for the existence of events present in succession in the scene, where the spectator does not need to possess a belief on causality between the events,

2 The belief $bel(Spx, visContiguous(E1, E2))$ (the spectator Spx believes that $E1$ is contiguous visually to $E2$) is defined from the primitive $next(Segx2, Segx1)$, where $Seg2$ is presented in the narration immediately after the filmic segment $Seg1$):

$$
\begin{array}{l}
mev(T4, bel(Spx, visContiguous(E1, E2))) \leftarrow \\
\quad visAct([T1, T2], Spx, Segx1, [Td1, Td2], E1), \\
\quad visAct([T3, T4], Spx, Segx2, [Td3, Td4], E2), \\
\quad next(Segx2, Segx1), time(T4).
\end{array}
\tag{3.2.3}
$$

with

$$
\begin{array}{l}
next(Segx2, Segx1) \leftarrow \\
\quad \#succ(Segx2, Segx1), \\
\quad diegeticSegment(Segx2), \\
\quad diegeticSegment(Segx1).
\end{array}
$$

to reach the belief that $E1$ precedes $E2$. Also the rule (3.2.4) does not have a counterpart in the literary text, because the written tale does not develop in a chronological time. For example in the text, "One day John will go to his mother's house, last time he was in that house ten years before" there are two sentences in sequence in the telling, but the story events are in a reverse order respecting to their presentation. In a scene from a movie, instead, the spectator always assumes that events showing in sequence, are diegetically sequential (for this figure of anchorage you consider the case $A5$ in figure 3.6.7).

If events $E1$ and $E2$, belong to the same scene and they are simultaneous (see graphic in figure 3.6.7 case $A7$) – then $E1$ and $E2$ generate an important implication: $E1$ and $E2$ happen in the same diegetic space – the rule is the following[3]: Spx believes that $W2$ is $W1$ if the vision act of $Segx$ happens; the vision act of $Segx$ happens; the space in which $E1$ happens is $W1$; and the space in which $E2$ happens is $W2$. In the formal way:

$$\begin{aligned}&mev(Tx, bel(Spx, sameWr(W2, W1))) \leftarrow\\&visAct([T1, T2], Spx, Segx, [Td1, Td2], [E1, E2]),\\&Tx = T2 + 1,\\&mev(Tx, bel(Spx, where(E1, W1))),\\&mev(Tx, bel(Spx, where(E2, W2))).\end{aligned} \tag{3.2.5}$$

I will use often forward in this book this inference, also to highlight some contradictions that the spectator is forced to operate when this rule is violated. Always in the hypothesis of events occurring in a same scene, it exists the possibility of events that are overlapping, sharing a same participant (human or even a physical object) and a same space of happening. An example of overlapping events is present in a scene in the end of *Pulp Fiction*. Vincent Vega (John Travolta) points ($E1$) the gun at the girl who has attempted to rob people in the bar and in the same scene the girl points ($E2$) the gun at Jules. $E1$ and $E2$ are two events that share the same participant – the girl is both a participant in the event $E1$ and in the event $E2$. The case discussed leads to define a cognitive rule which states that: Spx believes that $E1$ overlaps $E2$ if

3 Recall that in the inference 3.2.5 the term $[Td1\text{-}Td2]$ represents the diegetic interval where happen the story events of the entire segment filmic $Segx$ – both events $E1$ and $E2$ happen inside of such interval.

Figure 3.2.2: Intersections of events - Mexican standoff in *Pulp Fiction*

the vision act of $Segx$ happens; Spx believes that Px participates in $E1$ and $E2$.

$$\begin{aligned}
&mev(Tx, bel(Spx, over(E1, E2))) \leftarrow \\
&visAct([T1, T2], Spx, Segx, (E1, E2)), \\
&prec(T2, Tx), && \text{\% Tx is the mental time} \quad (3.2.6) \\
&mev(Tx, bel(Spx, who(E1, Px))), && \text{\% of } Spx \text{ after } T2, \\
&mev(Tx, bel(Spx, who(E2, Px))).
\end{aligned}$$

Finally, I report the case of events present in the same scene that are juxtaposed into same shot in different boxes on the screen - I refer to the case of **Split Screen** (see graphic in figure 3.6.7 case $A9$). These narrative figures show in the same shot two or more events that are spatially far. The events present in a Split Screen, although they are not intersecting, are often connected by communication means such as the telephone, a radio transmitter, and so on. In any case, these narrative devices determine in the spectator two panes (or more than two), in which are present the events $E1$ and $E2$ – for this events is valid the belief:

$$bel(Spx, eq(E1, E2))$$

Two events that are present in Split Screen modality happen then diegetically in the same time interval. An extreme form of split screen is present in *Time-*

(a) beginning of the sequence

(b)

(c)

(d) end of the sequence

Figure 3.2.3: Split Screen in *The Eyes*

code[4], where, in four separate quadrants, four stories are shown on the same screen. The stories are synchronized using some tricks – one of them is an earthquake – which in the moment it happens is shown, at the same narration time, in all four quadrants. This representation induces the spectator to consider the story events happening in the same temporal and diegetic interval.

Another complex Split Screen is present in *Eye of the Beholder*[5] Joanna Eris (Ashley Judd) lives in an apartment adjacent to that of Stephen Wilson (Ewan McGregor). In a scene (figure 3.2.3 (a)) Joanna is framed while having a bath in the tub. In the sequence that follows in the telling (3.2.3 (b)) Stephen approaches the wall of the bathroom of the apartment where he lives, and imagines Joanna on the other side of the wall. Later it is reported (3.2.3 (c)) in a same shot, both Stephen near the wall who eavesdrops and imagines what happens on the other side, and Joanna in the tub. The scene looks like an

4 [Timecode]

5 [EyeoftheBeholder] – *Eye of the Beholder* Starring Ewan McGregor, Ashley Judd, Geneviève Bujold.

overhead shot that frames our characters, in their two bathrooms, separated by a wall. The spectator perceives the sequence as an original (but real) shot from above (from the ceiling). This occurs as the direction puts the camera in the described position – after a slow movement of the camera that starts from the bath of Stephen till the final position (3.2.3 (c)).

Although there is a great verisimilitude with the prospectives to which we are accustomed to see in the events of everyday life, technically the shooting is a Split Screen, that is a juxtaposition of two scenes: a camera cannot stay in that position (unless it should be a room with no ceiling – which obviously is not). Subsequently a new scene is shown, another Split Screen is presented in which Joanna's images are superimposed in transparency to Stephen's images (3.2.3 (d)).

In both Split Screen (c) and (d) we are in a not plausible shooting location compared to real-life situations - what happens is that the spectator is *drugged* by the events of the story (for example, by Stephen's feeling/desire for Joanna), and assumes a point of view that observes the scene above or from the side of the two rooms.

3.3 SEQUENCES OF CONTIGUOUS SCENES

The direct proportionality to 45 degrees is not valid only to scenes, but also for sequences composed by scenes, in which the events are held in contiguous diegetic spaces – such structural combinations concern two important narrative categories: the **chase and dialogue** between characters.

Let's take for example the chase of the speedboats in Venice in *Italian Job*[6]. This segment consists of five scenes sc1, .., sc5 (see figure 3.3.1). In sc1 a pursuer points$_{e1}$ the gun at Lyle and Rod who are on a motorboat. In sc2 Lyle is afraid$_{e2}$, but soon after, he distracts his pursuer by pointing$_{e3}$ his eyes on a boat anchored lying in the direction of the pursuer boat. The pursuer in sc3 looks away from Lyle and Rod and looks$_{e4}$ forward in the direction of the boat anchored, where his hull, at full speed, is heading. The hull hits$_{e5}$ the anchored boat, and flies$_{e6}$ up. Lyle laughs$_{e7}$. The sequence that I have annotated, is constructed by scenes alternating between pursuers and pursued

6 [TheItalianJob]

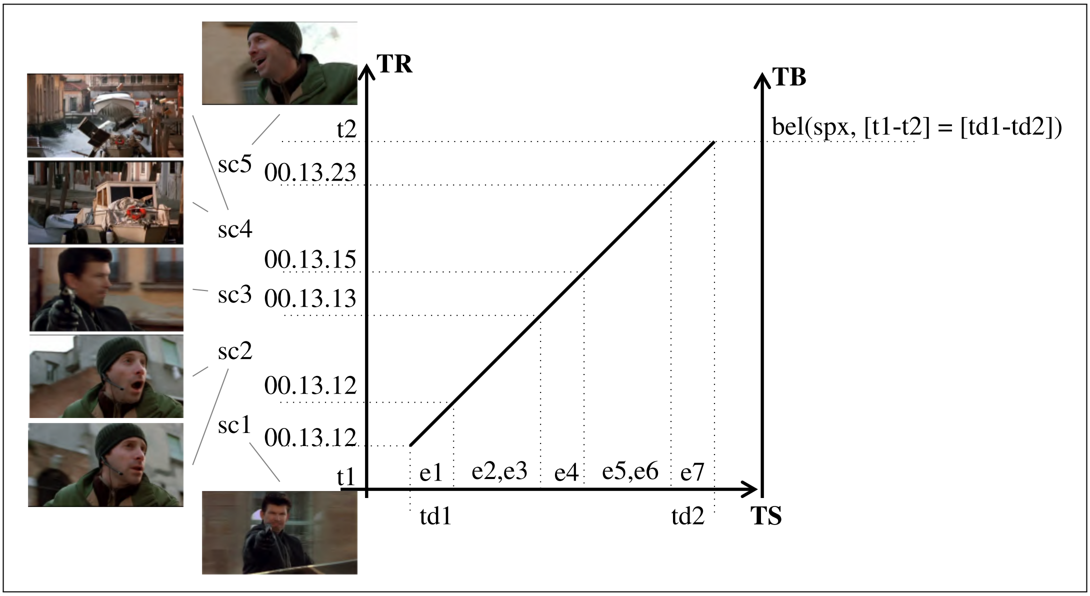


Figure 3.3.1: Sequences of contiguous scenes - in *Italian Job*

(Lyle and Rod), where in correspondence of each passage (cut) between pursuers and pursued, there is a casual precise relationship among events. Lyle's fear reported in the event $e2$, for example is a direct consequence of the gun pointed at Rod by the pursuer.

Although in correspondence of $e1$ and $e2$ there was a cut, due to the fact that it was necessary to focus the protagonists from different points of view, $e1$ and $e2$ are contiguous for the spectator. That is $e2$ follows immediately after $e1$ ($\mathtt{meets}(e2, e1)$). Let's see how the spectator assumes this belief. First of all the spaces where events occur $e1$ and $e2$ are contiguous. This condition suggests the spectator that among the areas where occur $e1$ and $e2$ there is no other spaces and so there are no events occurring between $e1$ and $e2$. In other words, the spectator believes that in the transition from the frame in which Lyle appears to that of his pursuer, nothing happens - and then there is not any diegetic time that *is consumed*. Such an assumption or belief is also supported by that "pointing a gun at some person Px" and "the manifestation of Px's fear", are usually separated events by a very small interval (it confirms the fact that the chronological time of narration between $sc1$ and $sc2$ is almost zero). For the reasons set out above – the spectator believes that $e1$ and $e2$ are diegetically contiguous.

That just discussed, is a special case of a general cognitive rule which establishes that causality between two events $E1$ and $E2$ and contiguity of the spaces where $E1$ and $E2$ occur, are sufficient conditions to infer that $E1$ and $E2$ are diegetically contiguous. We can represent the contiguity of two events $E1$ and $E2$ with the term $bel(Spx, meets(E1, E2))$, in this way: Spx believes that $E2$ immediately follows $E1$ ($meets(E2, E1)$) if: Spx believes that $E1$ finishes before Tdx; and Spx believes that $E2$ starts from Tdx.

$$\begin{aligned}&mev(Tx, bel(Spx, meets(E2, E1))) \;\leftarrow\\ &mev(Tx, bel(Spx, when(E1, until(Tdx)))),\\ &mev(Tx, bel(Spx, when(E2, start(Tdx)))).\end{aligned} \tag{3.3.1}$$

A cognitive rule generating a temporal contiguity belief starting from a causal relation between two events $E1$, $E2$ and a spatial contiguity between the same, is the following: Spx believes that $E1$ immediately follows $E2$ Spx believes that $E1$ immediately follows $E2$ if the acts of vision relative to filmic segments $Seg1$ and $Seg2$ happen; Spx believes that: $E1$ causes $E2$; in the diegetic space $Wr1$ $E1$ happens; in the diegetic space $Wr2$ $E2$ happens; and diegetic spaces $Wr2$, $Wr2$ are contiguous. In formal way:

$$\begin{aligned}&mev(Tx, bel(Spx, meets(E1, E2))) \leftarrow\\ &\;visAct([T1, T2], Spx, Seg1, [Td1, Td2], E1),\\ &\;visAct([T3, T4], Spx, Seg2, [Td3, Td4], E2),\\ &\;prec(T4, Tx),\\ &\;mev(Tx, bel(Spx, cause(E1, E2))),\\ &\;mev(Tx, bel(Spx, where(E1, Wr1))),\\ &\;mev(Tx, bel(Spx, where(E2, Wr2))),\\ &\;mev(Tx, bel(Spx, contiguous(Wr1, Wr2))).\end{aligned} \tag{3.3.2}$$

In the inference 3.3.2 it is essential that there is causality between that events $E1$ and $E2$, because this relation ensures the order among the events. Let's assume that $E2$ was presented in the story before $E1$, the causality between $E1$ and $E2$ requires that the spectator has always to believe that $E1$ meets $E2$ ($bel(Spx, meets(E1, E2))$) – I have also to remember that $meets(E1, E2) \neq meets(E2, E1)$. Observations made on the events $e1$ and $e2$ in the example of the pursuit in *Italian Job*, also apply for couples of events $e3$-$e4$, $e5$-$e4$ and $e6$-$e7$, where despite the cuts existing respectively between continuous scenes $sc2$-$sc3$ and $sc3$-$sc4$ and $sc4$-$sc5$, the spectator makes the assumption (for the contiguity of the spaces where the actions take place) that the pairs of events considered are temporally contiguous.

For the reasons just reported, for the sequences of scenes spatially contiguous in the example of Italian Job, it's valid the mental condition

$$bel(Spx, sameDur([t1, t2], [td1, td2]))$$

that is, the spectator believes that the time of narration is the same as the time of story (see figure 3.3.1). Such cognitive condition is true, not only for the chase and the dialogue, but for other important categories of sequences, where pairs of events are separated by spaces connected by equipment such as telephone, mobile phones, radio transmitters, chatting tools, etc.

3.4 CHRONOLOGICAL TIME OF NARRATION AND COGNITIVE TIME

Before finishing the analysis of the initial episode in *Italian Job*, it is worth to discuss a particular structural feature of this sequence, which concerns the discrepancy existing between the chronological time of vision (the one perceived by the spectator in the room) and the diegetic time explicitly represented by a clock or a character's statement in the diegesis.

In the diagram TN-TS-TB (figure 3.4.1) I reported the representation of the theft episode in *Italian Job*, after the explosion that breaks down the floor and makes the safe precipitate in the water of the garage of the boats (boathouse) of the Venetian House. After the explosion, the story shows some sequences that alternate the events relating to the opening of the underwater safe and the one pursuit of the boat driven by Handsome Rod, wherein the police assumed that the thieves carry the stolen gold. From the boat Lyle intercepts ($e1$) the radio communication made to the police - who has been advised of the theft - and Lyle sends such news to the rest of the gang. Charlie Croker (Mark Wahlberg) looking ($e2$) his diving watch, and reminds to John Bridger that

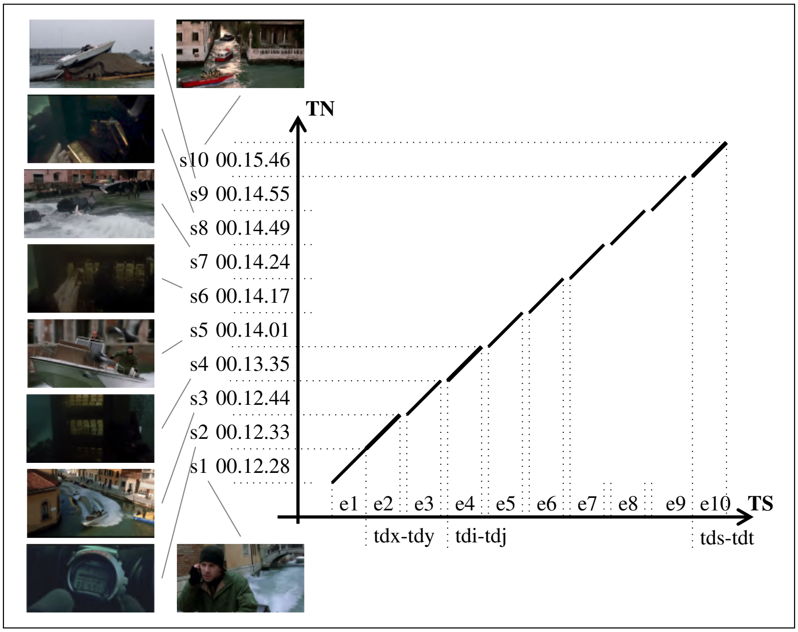


Figure 3.4.1: Alternate sequence of the theft to Venice in *Italian Job*

from that moment they have 7 minutes to open the safe. Meanwhile the chase (e3) continues along the canals of Venice. When the safe is opened Charlie (e4) declares that they have just four minutes to load the gold and leave. The story follows with Handsome Rod and Lyle still pursued (e5) by the police boats.

Later in the narration the operation of loading continues (e6). During the chase a gondola is split (e7) in two with the curse of the gondoliers. The last gold bars are loaded (E8) and then Rod Handsome and Lyle with the help of the garbage collectors make the hull of the trackers run around (E9) on the collection raft of debris. The police's boat reaches (e10) the Venetian house where the theft occurred, meanwhile underwater gold is carried away with the hulls.

Key elements of the analysis are as follows: in the sequence s2 (figure 3.4.1) Charlie says his partners that there are seven minutes available for theft before the police arrives. The police, however, comes (sequence S10) only after 3 minutes and 18 seconds of the narration time (measured with a clock). One could argue that the police (without that in the story is uttered the arrival of the boat in advance) has arrived four minutes earlier than expected. However, there is another temporal reference I have to consider in this analysis: after the opening of the safe, Charlie says that there are four minutes left to load the gold and then go away. So, there is no doubt, three minutes have (diegetically) passed since Charlie for the first time has consulted his watch, while the range of chronological time of narration, in correspondence of such events, is about one minute.

The above analysis let us reflect. First of all, I have to say that no one spectator when watching a movie equips himself of a stopwatch and measures the time of narration, least of all, compares them with the time of story. This occurrence besides as of farcical order, never occurs and the spectator does not almost recognizes temporal discrepancies of such kind. Yet the one in *Italian Job* is an anomaly[7]. I believe that narrative phenomena of this kind have led some scholars as G. Rondolino and D. Tomasi *to launch signals* of caution on the adoption of G. Genette's analytical tools.

> I underline, then how it could be important not to conceive in a too mechanical way, chronometrical we could say, the four categories (pause, extension, scene and summary) designed by G. Genette. The assessment of the duration cannot be limited to the simple relationship "duration of the story: duration of the telling". We must therefore taking into account the relationship between duration and content of each single image or episode[8].

Despite the warning of caution in the quotation above, I believe that the relationship TN/TS is a great tool to analyze the temporal structures of the movie stories (in the methodology analysis I use in this book, I will make an extended use). However, I think it is useful to use in addition to the axis of narration and that of history TN, TS, the axis TB of temporal beliefs (presented in the previous section). Through this axis to represent the perceived

7 An analysis similar to the one that I are reporting, was carried out by S. Ghislotti, for the film *High Noon*, in his book *Film Time* [Ghislotti2012] pp. 124-126 – *High Noon* [HighNoon] is a western film directed by Fred Zinnemann (1952), in which the time through a series of diegetic watches is shown to scan a countdown before the moment climax of the story (noon).

8 [Rondolino2011] p. 38

(believed) duration of the spectator concerning the diegetic events. I use the representation:

$$\mathsf{bel(Spx, Ex).}$$
$$\mathsf{bel(Spx}, when\mathsf{(Ex}, on\mathsf{([Td1, Td2]))).}$$

With this other tool, in the analysis of the sequence in *Italian Job* so far discussed, three temporal durations emerge: a chronological duration of the narration, a diegetic duration (represented by the periods set out explicitly in the diegesis by the characters or through watches) and a mental duration of the spectator. perceived by the spectator during the vision of the sequences. These durations can be represented through the diagrams TN-TS-TB. If we insert also the annotations of beliefs concerning temporal durations of the spectator – these beliefs may also be in conflict with the chronological durations of vision or with the diegetic durations exhibited through clocks presented on the screen. It is exactly what happens in the example of *Italian Job* – for this reason my proposal for the sequence I analyzed (but applies in general) is as follows (see figure 3.4.1):

$$\mathsf{bel(spx, eq((t1, t10), (tdx, tdy)))} \tag{3.4.1}$$

That is, the spectator spx believes that the duration of the story events is the same as the duration of vision. The diagram 3.4.1 seems to express an incongruity: the sum of durations of segments narrated ($\sum_{i=1}^{9}(\mathsf{Ti\text{-}Ti{+}1})$) is lower than the sum of the events durations($\sum_{i=1}^{9}(\mathsf{Tdi, Tdi{+}1})$) – and yet the spectator believes that the durations are equal (figure 3.4.1).

In this case the cinema, which is certainly unbeatable as a manipulation tool, maintains fully expectations: the story has manipulated and confused the spectator up to make him *perceive* a time duration longer than the one he himself *lived* – or also from another point of view, the spectator adapts his perception of the temporal duration: to the diegetic events duration; to the time marked by the diegetic watches; to the duration stated by the story characters. However, perhaps the best answer, to the apparent contradiction, I believe would be in strictly analytical terms: an effective comparison between the duration of vision and chronological duration enunciated in the diegesis, makes use of a tool (one clock) possessed by an external observer (who is never the spectator) who is not involved in the vision of events – while the perception

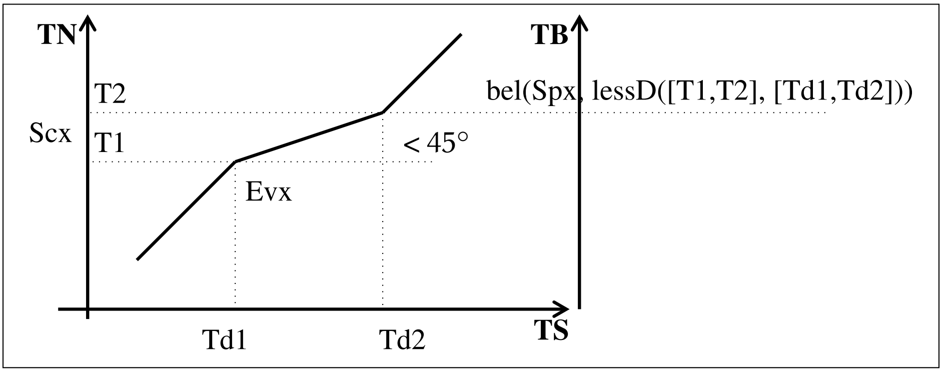


Figure 3.5.1: Summary for accelerating of events

of the diegetic events duration, is a question (cognitive) that regards just the spectator – this latter frequently gets confused by the emotions of the story events shown on the screen.

The analysis based on time of narration (TN) and time of story (TS) therefore, may be incomplete, in the sense that the only relationship $\triangle\mathsf{TN}/\triangle\mathsf{TS}$ does not suggest spectator's cognitive state. I am convinced that the inclusion of beliefs annotations on the axis TB (mental time axis), can bridge such incompleteness.

3.5 SUMMARIES

The summary is a mode of events presentation that has the aim to represent a diegetic interval time *flowing* faster than the time of story ($\triangle\mathsf{TS} > \triangle\mathsf{TN}$). You can represent this condition in two ways. One way is to speed up the actions present in the events, which can also be done on a symbolic level. Examples of such summaries are those using accelerations of the hands of a clock, sheets of a calendar browsed quickly, butts accumulated quickly in an ashtray, empty bottles of alcohol that grow rapidly in number and so on.

We will call such relationships between narration time and story time – **summaries for acceleration of events**. These summaries are presented, in a diagram TN-TS-TB, through a segment forming an angle minor than 45 degrees with the axis of the abscissas.

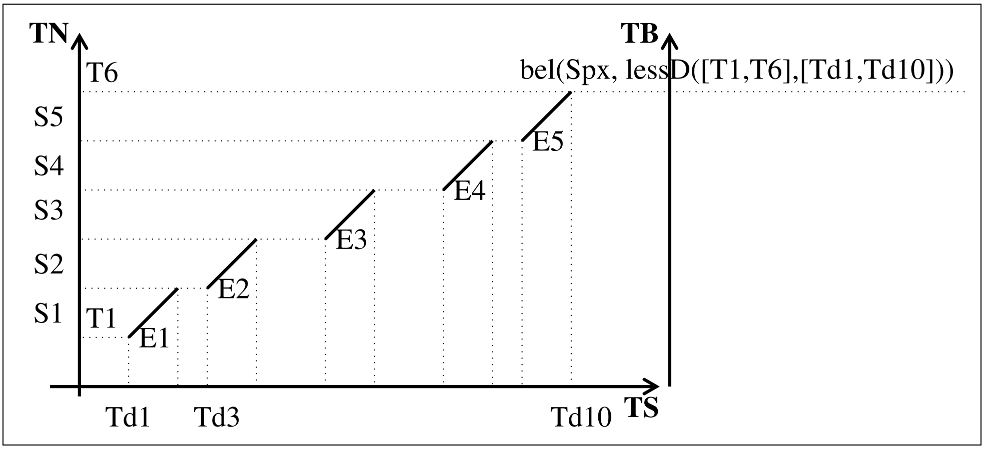


Figure 3.5.2: Explicit summary through elimination of events

I consider summaries also filmic segments showing only the most relevant events of a part of a story (figure 3.5.2). Examples of these kinds of summaries, in which there is a deleting of events, are quite frequent and regard representations in which a character talks on a phone without having shown the formulation of the number, a going to a place of a character, without having shown every detail of his route etc.

Humorous and surprisingly is the summary of *The Graduate* [TheGraduate], where Ben (Dustin Hoffman) accompanies Elaine Robinson (Katharine Rossal) to the door of the lecture room at the University of Berkeley, then we find the same Ben in the event that immediately follows in the narration, out the door. From the story has been eliminated the Ben's waiting and the event relative to Elaine's lesson.

In some summaries, the elements of narration are reduced to a very small number of events, until the latter constitute almost symbolic icons – such as William Thacker's walk (Hugh Grant), when crosses the neighborhood of *Notting Hill* in the movie *Notting Hill* (figure 3.5.3). In this part of the telling the diegetic time passes from autumn, to winter, to spring, and then to summer in the time of narration in the order of a minute. Another example, that falls into this type of summary, is present in a sequence of *Doctor Zhivago*[9] where, in an interval vision of a few seconds, the time of story stretches from win-

9 *Doctor Zhivago* [DoctorZhivago] is a movie directed by David Lean, with Omar Sharif, Julie Christie, Geraldine Chaplin and Rod Steiger.

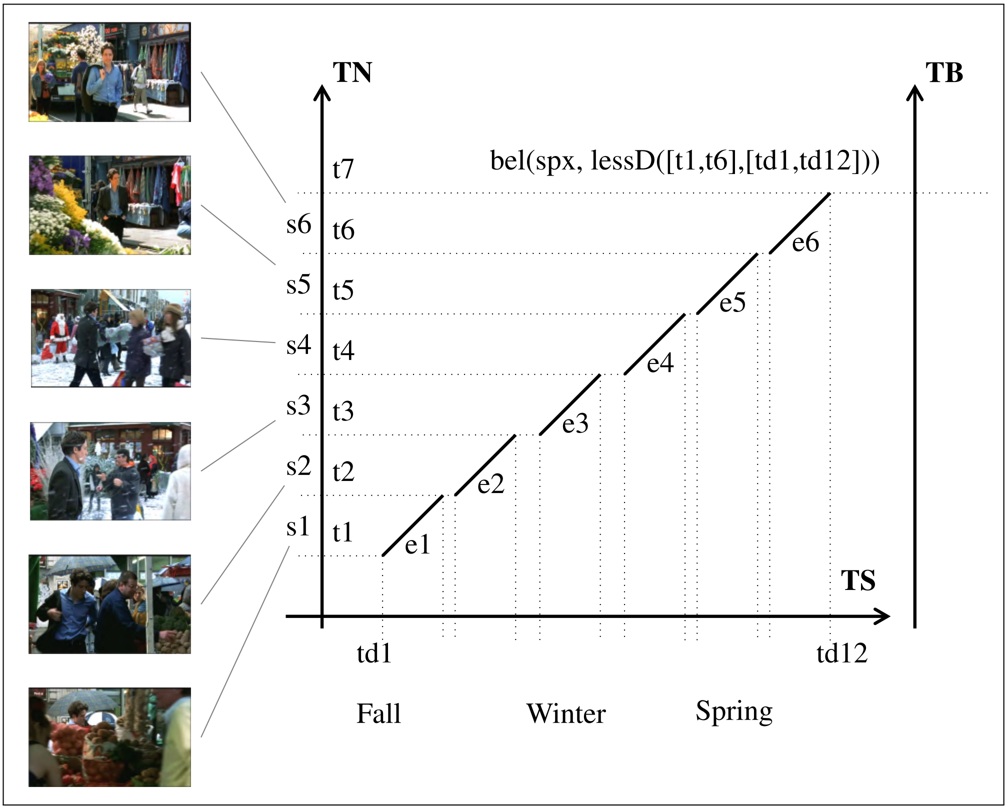


Figure 3.5.3: Summary through eliminations of events in *Nothing Hill*

ter to summer (figure 3.5.4). For explicit summaries through elimination of events[10], the temporal contraction of the story events is clear and manifest to

10 In the book [Rondolino2011], p. 215, the summaries I nominated ”through elimination of events” fall in the category of episode sequences, placed as subcategories of narrative ellipsis sequences – in fact these summaries are obtained by ellipsis.
My classification was led by cognitive aspects in which there are specific mental states present in the spectator who propose a new categorization of ellipsis sequences:

a) in the summary through elimination, the spectator Spx is aware of the ellipsis occurring in the telling – Spx believes that the time of story is shorter than the time of narration (TS<TN);
b) in the hidden summary the spectator, Spx is not aware of the ellipsis that are present in the telling – he believes that the time of story is equal to the time of narration $(TN{=}TS)$;
c) in the sequences with narrative ellipsis (called by us proper), the spectator Spx is aware of the ellipsis present in the telling and in correspondence to them Spx expects for a casual explanation for a given event present in the story $(waitSc(Spx, Ex, Ey))$.

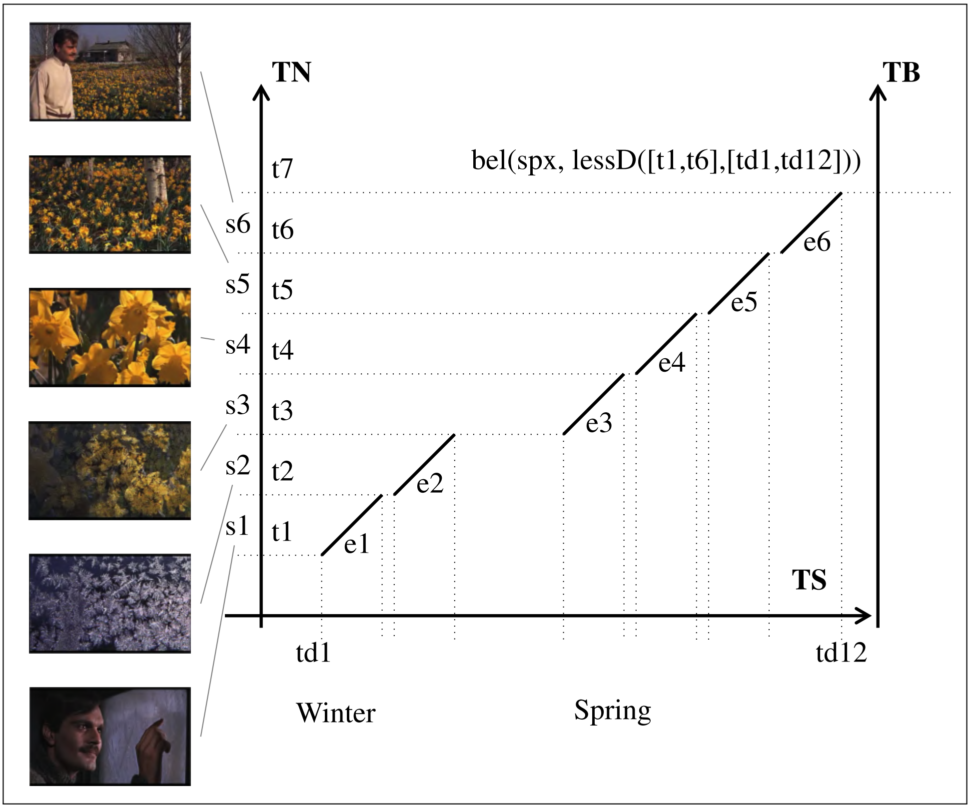


Figure 3.5.4: Summary through elimination of events in *Doctor Zhivago*

the spectator – there is therefore the belief that the time of narration is minor than the time of story ($\triangle$TN< $\triangle$ TS)). There are summaries that seem as epilogues of a story (sometimes non-linear), which are staged by memories of a character or a narrator. Examples of this kind are present in the final part of *The Burning Plain* [TheBurningPlain] and *Babel* [Babel] (both written by the screenwriter Guillermo Arriaga). In the first cited film the summary *happens* in Sylvia's mind (the protagonist) that runs through the stages of her life up to that moment of her story. While in the second movie the summary is performed by narrator's presence?

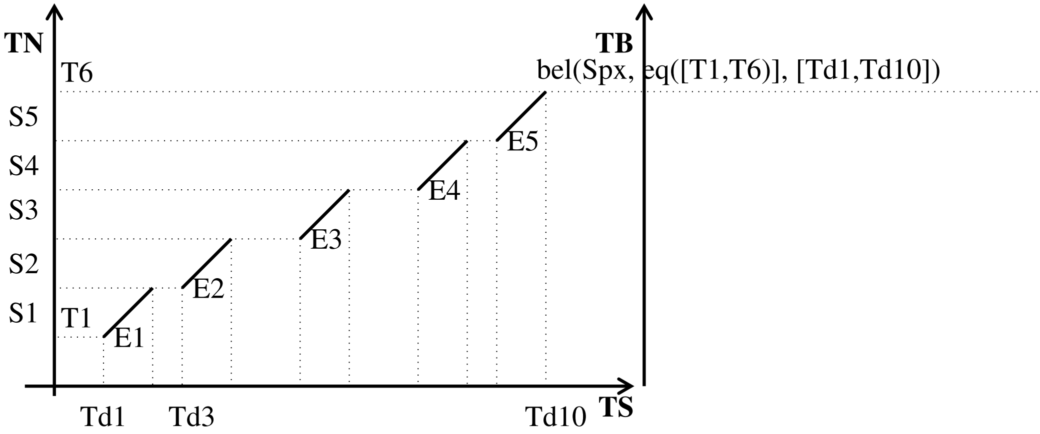


Figure 3.5.5: Hidden summary

3.6 ELLIPSES

Ellipses can be divided into two big categories: intra-sequential ellipses and inter-sequential ellipses (narrative ellipses). An intra-sequential ellipsis occurs within a group of visually contiguous and causally connected events[11].

An intra-sequential ellipsis presents the characteristics of a summary, a narrative structure that hide parts of the story, while maintaining a causal connection among the remaining parts. Intra-sequential ellipsis thus constitute a kind of hidden summary, where the spectator does not perceive a contraction of the story. In the hidden summary, the spectator believes that the time of the narration is equal to the time of the story (bel(Spx, eq([t1-t5], [td1-td5])), see figure 3.5.5). Inter-sequential or narrative ellipsis, however, take place between narratives entities (macro events, partial stories, etc.) characterizing decisively with the overall structure of the telling. For this reason I added the adjective "own " to the narrative ellipsis to better characterize them, from the inter-sequential ellipsis. A narrative ellipsis is usually regarded as a suppression of events where[12]:

11 In the chapter 7 I will formally define these sequences of events labelling them as macro events and its characteristic is that events that are eliminated have little influence on the story – this is obviously done to optimize the staging to improve the speed of the narration that are reflected also on the quality of the telling.

12 [Rondolino2011] p. 38

> in a fixed period of time in the story there is no corresponding interval of narration time. We are facing a textual silence, a temporal suppression that intervenes between two different actions, two scenes, two sequences or within the same sequence.

I formulate a model that identifies a specific cognitive state in the spectator that occurs in correspondence of a textual silence. The model assumes that the spectator, for every new event Ex of the story, has always a specific cognitive state that leads him to search in his internal repertoire, one or more rules that provide a casual justification with at least another event Ey belonging to the story. When the spectator does not find such a causal rule, it generates an expectation of an event Ey that causes Ex. When the event Ey is shown in the diegesis, then Ex will be connected to all the events that caused Ey. It determines then a cognitive state of expectation for a causal explanation that qualitatively is equivalent to the question: why did Ex happen? What is the event (or chain of events) that caused it?

The determination in the spectator, of a cognitive mental state just described – is a technique very effective to improve the fruition of a story. The emptiness of the story leaves the spectator *hungry* of new events or clues that may provide additional knowledge of the story, to fill the emptiness created. After that an ellipsis has been staged, the narration continues for showing other events about which the spectator doesn't know neither who nor what caused them. The lack of knowledge – generated by a narrative ellipsis – creates a cognitive state of expectation in the spectator - which buys more attention and reactivity to events presented in the story with a consequent greater participation.

My methodological goal was to characterize narrative ellipses, locally, that is, for how they present themselves, without taking into account other aspects regarding the subsequent phases of the temporal-causal connection existing in the story (the argument relating to the fitting will be discussed in chapter 5 dedicated to deixis).

A TAXONOMY FOR NARRATIVE ELLIPSES. To individuate the classes of ellipses, I start from the rewriting in cognitive terms of ellipsis categories proposed by G. Genette[13], in which I insert, in the description of the cate-

13 Topic presented in [Genette1986] p. 155.

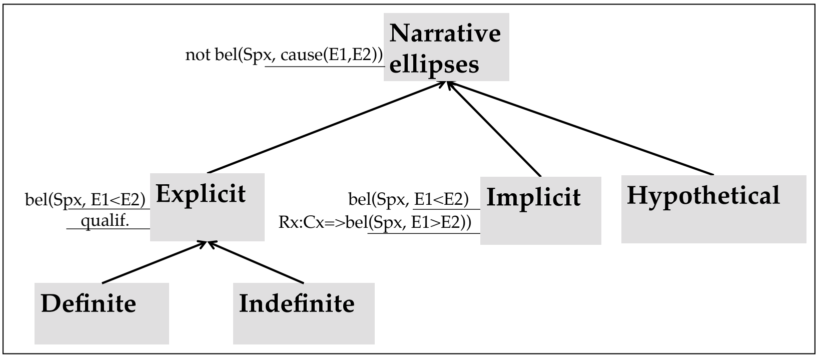


Figure 3.6.1: Taxonomy of narrative ellipses

gories presented by the author, elements of cognitive character, in the form of temporal and causal beliefs of the spectator.

All the ellipses occur (a) between two events $\mathsf{E1}$ and $\mathsf{E2}$ visually contiguous and (b) in the lack of a belief in the spectator of a causal relationship ($\mathsf{bel(Spx, cause(E1, E2))}$) between $\mathsf{E1}$ and $\mathsf{E2}$. Respecting of condition (a) and (b), I distinguish the following ellipses subcategories:

-Explicit ellipsis occurs in the presence of a spectator's belief on a relationship of temporal order between two events ($\mathsf{bel(Spx, prec(E1, E2))}$) – this belief is generated after the explicit utterance of a temporal relationship in the filmic text – a caption or extradiegetic voice which reports a temporal relation (qualitative or quantitative) between events;

-Definitive ellipsis occurs in relation to a belief on a relationship of the temporal order, acquired by the spectator through an explicit statement of a chronological time in the story – or by an explicit statement of a quantitative temporal relationship (seven days after, one hour later) – these ellipses are clearly a sub-category of explicit ellipses;

-Indefinite ellipsis occurs when a temporal belief is acquired by the spectator through a qualitative temporal relationship enunciated in the story (some time later, much time later, a few years later etc.) – (clearly a sub category of explicit ellipsis;

-Implicit ellipsis occurs when a temporal jump on the story is not stated in the filmic text - but it exists an spectator's inference who determines that there was a time gap – forward (prolepsis) or back (flashback) in the story;

-Hypothetical ellipsis occurs when the belief of a temporal relationship relative to ellipsis is not acquired by temporal relations and/or chronological time explicitly present in the story and additionally the spectator does not have any cognitive rule that permits him making the inference;

-Qualified ellipsis occurs when for a temporal jump in the story a reason (or any reason) is given to understand why this jump has made necessary

The analysis[14] in table 2 leads to the construction of the ellipses categories shown in figure 3.6.1, recalling that two categories of ellipses belonging to a same super-category if it shares at least two common attributes.

	NO CAUSAL RELATION	EVENTS VIS. CONTIGUE	DETER. TIME	INDETER. TIME	INFERRED INTERVAL
Definite	x	x	x		
Indefinite	x	x		x	
Eplicit	x	x	x	x	
Implicit	x	x			x
Hypothetical	x	x			
Qualified	x	x	x	x	

Table 2: Types of ellipses

I present a cognitive formal model of ellipsis (see figure 3.6.2) that is valid both to explicit ellipsis and to the implicit one. The presence of an ellipsis is perceived by a spectator Spx when he believes that an event Ex is relevant[15]

14 The analysis reported qualitatively is similar to the methodology of Formal Concept Analysis [Carpineto2005], [FCA]

15 I believe that the introduction in the representation of a notion of ”relevant event”, does not violate my prerogative of building cognitive models considering the story events as local phenomena on the temporal axis of the narration. In fact, a belief on the relevance of an event, rises in the spectator in correspondence of particular events – for example when a character is in danger, that is in an instant of narration where the spectator expects how this character will avoid the hazard. In situations as this, it is not necessary that the spectator makes an analysis of all story events and compares them to establish that an event is relevant. Almost always the relevance of an event is evaluated for the existence of a character’s property in a certain point of narration.

to the story Stx ($bel(Spx, relevant(Ex, Stx))$) has not had an explanation, that is, when he has not identified a causal rule so that Ey causes Ex.

Spx owns a mental expectation state about a causal explanation if he believes: Ex happens; Ey happens; Ey and Ex belong to the same story Stx; Ex is visually contiguous to Ey; Ey precedes Ex; there is no causality between Ex and Ey; and Ex is relevant to the story Stx.

$$\begin{aligned} & mev(Tx, addBel(bel(Spx, expectSc(Ey, Ex)))) \leftarrow \\ & \; mev(Tx, bel(Spx, Ex)), \\ & \; mev(Tx, bel(Spx, Ey)), \\ & \; mev(Tx, bel(Spx, sameStory(Stx, Ex, Ey))), \\ & \; mev(Tx, bel(Spx, visContiguous(Ex, Ey))), \\ & \; not\ mev(Tx, bel(Spx, cause(Ey, Ex))), \\ & \; mev(Tx, bel(Spx, relevant(Ex, Stx))). \end{aligned} \tag{3.6.1}$$

In correspondence to an "Expectation of causal explanation" it is generated a spectator's belief that an ellipsis is happened in the story. The following implication holds: Spx believes that occurs an ellipsis between Ex and Ey if an expectation of causal explanation happens in the story.

$$\begin{aligned} & mev(Tx, bel(Spx, ellipsis(Ey, Ex))) \leftarrow \\ & \; mev(Tx, bel(Spx, expectSc(Ey, Ex))). \end{aligned} \tag{3.6.2}$$

If we add to the condition mev (Tx, bel (Spx, expectSc (Ey, Ex))) the beliefs $mev(Tx, bel(Spx, prec(Ey, Ex)))$, the ellipsis becomes explicit or implicit (this occurs if Spx's belief on the relation of order $prec(Ey, Ex)$ was shown in the filmic text or inferred by the viewer)

In the rule 3.6.1:

the condition $bel(Spx, sameStory(Str, Ex, Ey))$ regards the belonging of Ex and Ey to the same story Str[16], and excludes the case that occurs a space-character change of the story, for instance a change of episode – where obviously there isn't the causality between Ex and Ey;

16 $bel(Spx, sameStory(Str, Ex, Ey))$ represents a notion that I will be discussed in chapter 7, for the moment for the sake of simplicity we say two events Ex and Ey belong to the same story Str if they have in common at least a character.

the condition of not causality $\mathtt{not}\ \mathtt{mev}(\mathsf{Tx}, \mathtt{bel}(\mathsf{Spx}, \mathtt{cause}(\mathsf{Ey}, \mathsf{Ex})))$ characterizing condition of ellipsis figure, excludes the intra-sequential ellipsis, this latter temporally linked just by causal relationships, then such condition is necessary;

the condition of relevance $\mathtt{mev}(\mathsf{Tx}, \mathtt{bel}(\mathsf{Spx}, \mathtt{relevant}(\mathsf{Ex}, \mathsf{Stx})))$ is required to the occurrence of a narrative ellipsis. In situation in which, Ex has no relevance to the story, we find ourselves in the case of an intra-sequential ellipsis. The belief of relevance could be represented using a degree of relevance – the higher the grade, the greater is the expectation of explanation;

the $\mathtt{mev}(\mathsf{Tx}, \mathtt{bel}(\mathsf{Spx}, \mathtt{prec}(\mathsf{Ey}, \mathsf{Ex})))$ is a condition that denotes that the explicit ellipsis are strictly proleptic, that is that the story has to go forward in order that we can perceive a deletion of one or more events.

A going back of the story, on the other hand has the function to introduce parts of the story unknown to the viewer, or to explain why some events took place. This latter prerogative as I will see ahead of another narrative figure which is the flashback. I report (figure 3.6.2) the diagram TN-TS-TB as model for the implicit or explicit ellipsis. I emphasize once more that the model I present characterizes only the moment in which the forward temporal jump is shown, and not the next stage of fitting. The example shown in figure 3.6.2 concerns a case of ellipsis, after the breaking of the story, which is connected in a linear and continuous way with the rest of the story (in general the fitting that occur after an ellipsis, can also occur in a non-linear and discontinuous way).

Before an ellipsis is generated, generally n stories are active in a determined time of narration – when the ellipsis happens (usually) is interrupted only one of the stories. In figure 3.6.2 it is represented the explicit ellipsis in the movie the *Shawshank Redemption*[17]. We are at the point in the story, in which Red tries to comfort Andy who understands that the prison warden will make sure not to make clear the truth about his innocence. The stories of Red and Andy are divided – when the two enter their respective cells to spend the night. The story of Red continues to offer events in the telling – showing Red's sleepless night worried that Andy accomplishes something

17 *Shawshank Redemption* [TheShawshankRedemption] is a film directed by Frank Darabont, with Tim Robbins and Morgan Freeman, based on the telling by Stephen King *Rita Hayworth and the redemption Shawshank*. The movie is first in the top chart 250 drawn up by the Internet Movie Database users.

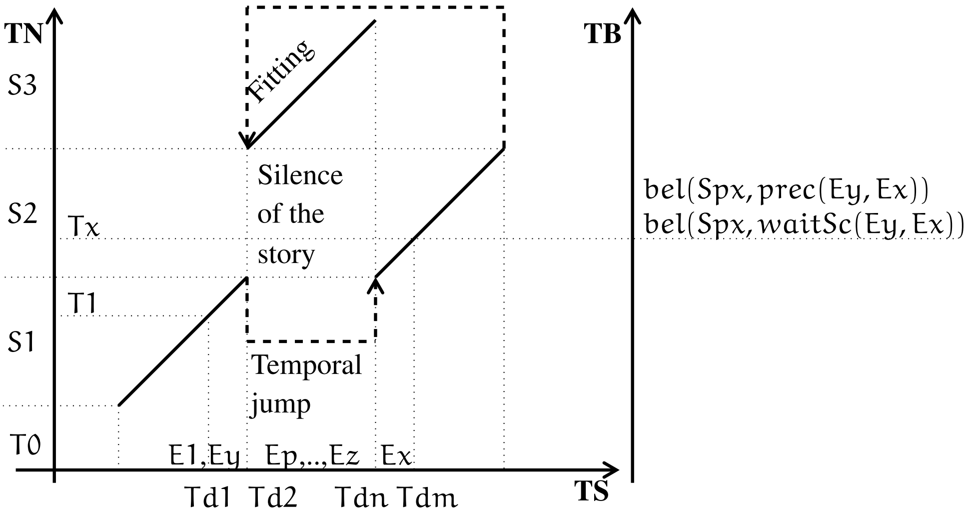


Figure 3.6.2: TN-TS-TB diagram for explicit ellipses

crazy with the rope that he has taken from the tool storage. The story of Andy, instead, is interrupted[18] and continues the following morning, with Andy's disappearance from the cell. It is in Andy's story which is present an ellipsis, in that of Red's there are no deletions – and it is in relation to what happened till that moment, in the story of Andy that the spectator question himself "why is Andy not in his cell?" It is clear to the spectator that the story has gone on. The characters are shown temporally to the spectator at the morning, after Red's sleepless night, this is reported explicitly by Red's extradiegetic voice (omodiegetic voice) – for this reason, the ellipsis is explicit. The spectator for providing an answer to the question posed, expects at least an event that can make as bridge between the part of story about Andy, before Red's sleepless night alone in his cell, and that one of Andy's disappearance

18 The example of *Shawshank Redemption* it deals with a specific narrative ellipsis that G. Genette in the literary text calls "paralipsis", that is an ellipsis concerning a diegetic interval of the story, with the lack of part of the story that happens on an interval already covered (Red's sleepless night happens on the same interval of time in which is present the elision in the Andy's story). For what it concerns the approach I have adopted, the omissions of facts in a particular diegetic interval, cause a discontinuity of the story only for some characters, this could does not happen for others characters. My methodology suggests to separately consider each partial story in independently way, and to analyze a paralipsis in the same manner in which we analyze the ordinary ellipsis, independently if on the same diegetic time others events are reported.

in its cell (see sequence S2 of figure 3.6.3). An expectation of causal explanation $\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{expectSc}(Ey, Ex)))$ is removed from the spectator's cognitive state when the causative relationship that determines that state is inferred by the spectator from new events of the story.

$$\begin{aligned} &\mathit{mev}(\mathit{remBel}(Tx, \mathit{bel}(Spx, \mathit{expectSc}(Ey, Ex))) \leftarrow \\ &\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{expectSc}(Ey, Ex)))), \\ &\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{cause}(Ey, Ex))). \end{aligned} \tag{3.6.3}$$

IMPLICITE ELLIPSES. An example of implicite ellipsis is present in the final part of the movie *Mediterraneo*[19], after the events relative to the departure of eight soldiers from the island ($E1$). The spectator expects the epilogue of the story, he wonders how the events related to the characters' stories have developed. In a segment of narration, the Lieutenant Raffaele Montini is framed on a ship carrying tourists. Raffaele is now old ($E2$) – gray hair and beard, tended to white. It is clear that the story is gone forward of many years. But what happened to the attendant Antonio Farina, who was hiding in a barrel of olives to avoid leaving the island? and Sergeant Nicholas Lorusso, who swore that he would change his country and the entire world? Spectator's questions, who lack answers or causal links that explain the occurrence of the events.

Ellipsis is implicit: there are not temporal expressions in the diegesis (or calendars, or people who refer in which year the events take place, etc.). The spectator, however, assumes that after the interruption of the story, time has passed – he definitely has a cognitive rule of the type: if an event $E1$ shows a character Px at a young age and another $E2$ shows the same character Px as old, then $E1$ precedes $E2$. The temporal inference just described is the following: Spx believes $E1$ precedes $E2$ if believes that: Px participates in

19 [Mediterraneo]

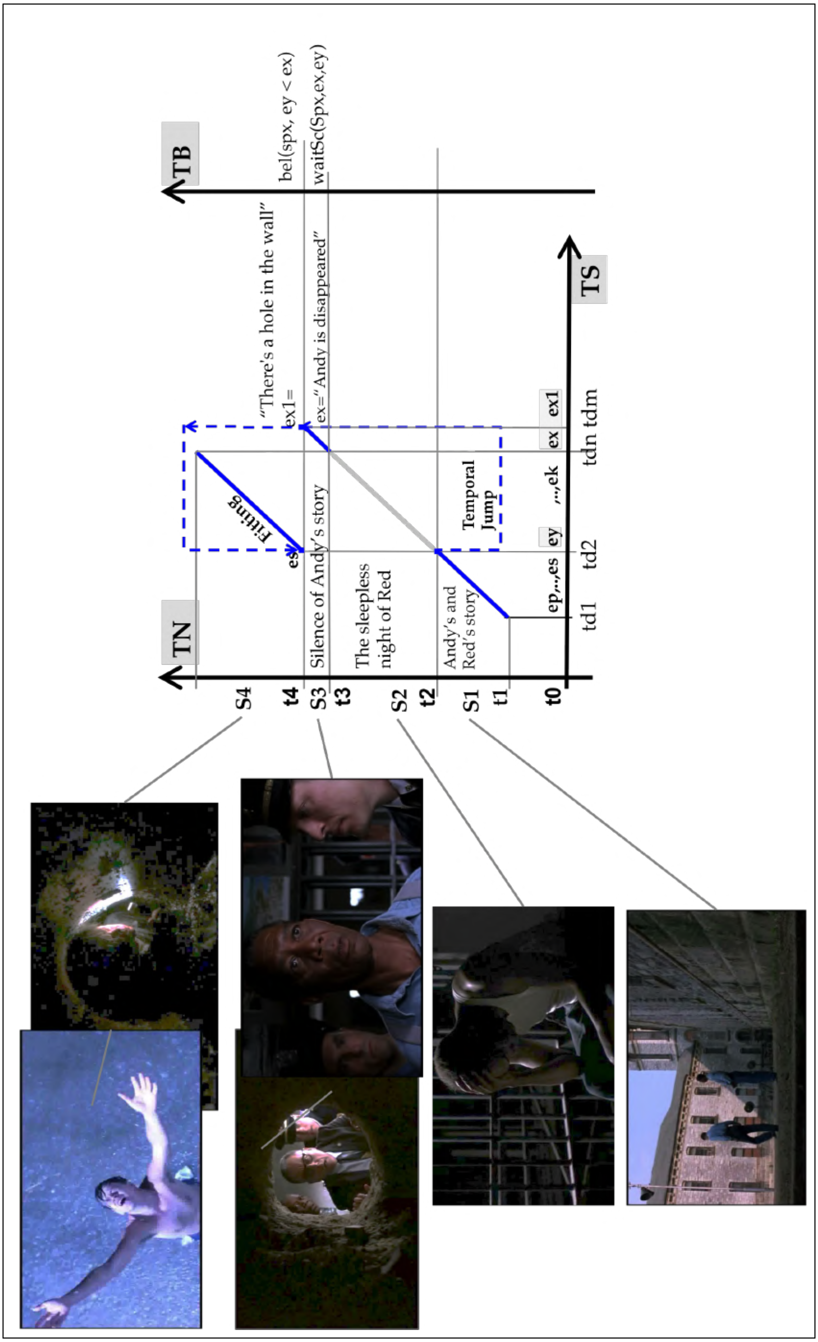


Figure 3.6.3: Explicit ellipsis in *The Shawshank Redemption*

Figure 3.6.4: Implicit ellipsis in *Mediterraneo*

$\mathsf{E1}$; Py participates in $\mathsf{E2}$; Px in $\mathsf{E1}$ is young; Py in $\mathsf{E2}$ is elderly; Px and Py are the same characters.

$$\begin{aligned}
&mev(Tx, bel(Spx, prec(E1, E2))) \leftarrow \\
&\quad mev(Tx, bel(Spx, who(E1, Px))), \\
&\quad mev(Tx, bel(Spx, who(E2, Py))), \\
&\quad mev(Tx, bel(Spx, propEv(E1, prop(age, Px, young)))), \\
&\quad mev(Tx, bel(Spx, propEv(E2, prop(age, Py, elderly)))), \\
&\quad mev(Tx, bel(Spx, sameP(Py, Px))).
\end{aligned} \tag{3.6.4}$$

The spectator after the event $\mathsf{E2}$ is in an expectation state of casual explanation – a *breaking* of the story axis, which as you know will be connected with the events in the point in which it is reported Raffaele's visit to Antonio Farina's house on the island. In such part of narration, Raffaele becomes aware that Antonio has opened the restaurant he dreamed of managing with Vasilisa (his wife) and is surprised by the presence of Lorusso who lives in the same house as Antonio and in which Lorusso claims to have given up on wanting to change his country and the world.

From a cognitive point of view, the phenomena of story breaking, such as ellipsis, are distinct from those of fitting, since they activate in the spectator different mental states. These latest narrative figures, have been called by us *temporal deixis for evocation* (I will discuss of them in chapter 5).

HYPOTHETICAL ELLIPSES. Hypothetical ellipses arise in correspondence of two events Ex and Ey contiguous visually, and such as all the ellipsis, with an interruption in the story, and an absence of a casual connection between Ex and Ey. For this particular group of ellipsis the spectator cannot, even through the activation of some cognitive inference, establish a temporal relationship between Ex and Ey. In these narrative figures, almost it occurs the lack of the condition $\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{sameStory}(\mathsf{Str}, \mathsf{Ex}, \mathsf{Ey})))$ (Spx believes that Ex and Ey belong to the same story). "We are at the limits of coherence of the telling" G. Genette[20] would say. It is a limit, however, only momentary, since the telling provides other events and occasions to let the spectator assume the causal and temporal relations missing.

When a hypothetical ellipsis occurs, the spectator owns two mental expectation states. The first ($(\mathsf{bel}(\mathsf{Spx}, \mathsf{expectCt}(\mathsf{Ey}, \mathsf{Ex})))$ is an expectation state of causal relations, see inference 3.6.5, of the same kind seen for the explicit or implicit ellipsis. The second state regards spectator's expectation of a temporal relation with another event Ex of the story, having the following definition: Spx owns a mental state of expectation about a temporal relation $(\mathsf{bel}(\mathsf{Spx}, \mathsf{expectCt}(\mathsf{Ey}, \mathsf{Ex})))$ if he believes that: Ey happens; Ex happens; Ey and Ex belong to the same story; Ex and Ey are visually contiguous; Ex does not happen on $[\mathsf{Tdm}, \mathsf{Tdn}]$; Ex does not happen before Ey; Ey does not happen before Ex; and Ex does not overlap Ey.

$$\begin{array}{l}
\mathsf{mev}(\mathsf{Tx}, \mathsf{add}(\mathsf{bel}(\mathsf{Spx}, \mathsf{expectCt}(\mathsf{Ey}, \mathsf{Ex})))) \leftarrow \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{Ey})), \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{Ex})), \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{sameStory}(\mathsf{Str}, \mathsf{Ex}, \mathsf{Ey}))), \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{visContiguous}(\mathsf{Ex}, \mathsf{Ey}))), \\
\quad \mathsf{not}\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ex}, \mathsf{on}(\mathsf{Tdm}, \mathsf{Tdn})))), \\
\quad \mathsf{not}\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{Ex}, \mathsf{Ey}))), \\
\quad \mathsf{not}\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{Ey}, \mathsf{Ex}))), \\
\quad \mathsf{not}\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{over}(\mathsf{Ex}, \mathsf{Ey}))), \\
\quad \mathsf{diegeticTime}(\mathsf{Tdm}), \mathsf{diegeticTime}(\mathsf{Tdn}).
\end{array} \tag{3.6.5}$$

The characterization of the hypothetical ellipsis is the following: Spx believes that an between Ex and Ey occurs, if an expectation $(\mathsf{bel}(\mathsf{Spx}, \mathsf{expectSc}(\mathsf{Ey}, \mathsf{Ex}))$

20 In [Genette1986] p. 158

of causal and temporal ($\mathsf{bel}(\mathsf{Spx}, \mathsf{expectCt}(\mathsf{Ey}, \mathsf{Ex}))$) explanation happens. Formally:

$$\begin{aligned} &\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{hypEllipsis}(\mathsf{Ey}, \mathsf{Ex}))) \leftarrow \\ &\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{expectSc}(\mathsf{Ey}, \mathsf{Ex}))), \\ &\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{expectCt}(\mathsf{Ey}, \mathsf{Ex}))). \end{aligned} \tag{3.6.6}$$

I provide only some models about how the spectator makes this acquisition, as the cases are in very numerous. The spectator when there is a hypothetical ellipse in the story, can only record in his memory the events to be anchored, reserving later in the telling, to place them on the axis of the story (see figure 3.6.5). In the end of the telling, it does not matter what the level of difficulty is, the spectator will build the fabula. If the viewer understood the story, he would put all causal and temporal relations on the story axis, and his registry of the expectations woulds remain empty.

21 grams [21Grams] is definitely one of the movie (if not the movie) with more hypothetical ellipsis – which are very numerous and are placed at the beginning of the telling. In the first sequence $\mathsf{E1i}(\mathsf{E11}, \mathsf{E12}, ..\mathsf{E1n})$ in which events occur they are presented two lovers (the spectator will know that their names are Paul and Cristina). In the second sequence $\mathsf{S2}$ there is a father with two girls who eat and drink in a pub. Events $\mathsf{E2i}$ constitute a hypothetical sequence where the spectator hasn't a sufficient knowledge for establishing a temporal relation with the previous sequence $\mathsf{S1}$. In the third sequence $\mathsf{S3}$ are shown people in a collective analysis session. The woman who speaks (Cristina) said that she has been very bad (maybe took drugs) until the birth of her first daughter. Here the viewer could make the inference (a weak inference) that the two children of the sequence S2 are Cristina's daughters. Such inference has a its cognitive justification: two little girls were presented in S2 and in the following sequence S3 a woman remembers when she had her first daughter – then Cristina has two daughters. The spectator could suppose then that the girls in the events $\mathsf{E2i}$ are Cristina's daughters. Forward in this book I will discuss about these kind of weak inferences – what is important in the analysis that I am doing, is that the type of relation among the characters I have pointed out, does not contribute to the identification of some belief on the temporal order, and so also the sequence of events E3i S3 must be labeled as hypothetical ellipsis.

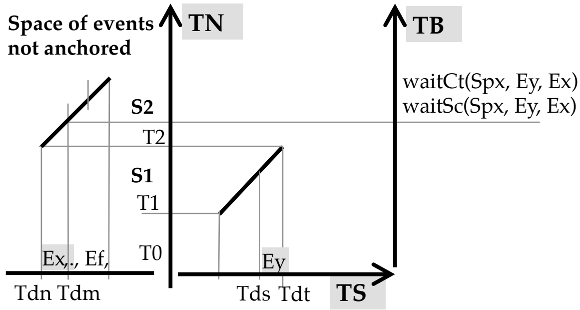


Figure 3.6.5: TN-TS-TB diagram for hypothetical ellipsis

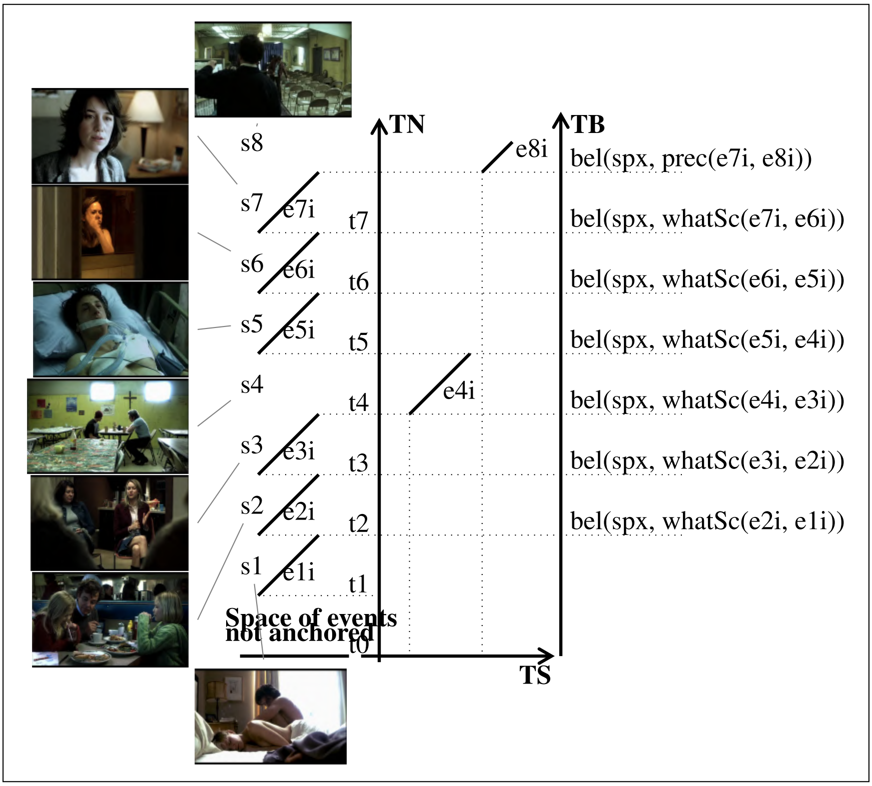


Figure 3.6.6: Hypothetical Ellipses in 21 Grams, after the eighth sequence

In the sequence S4 two characters are introduced in a context of parish environment for the recovery of socially unsuited young – also S4 does not provide a chance to the spectator that permits him to build some temporal relationship among events (the sequence presents events in which there is a total change of characters and environment with respect to the previous sequences).

In the next sequence S5, also if presenting once more the man (Paul) that was in the previous sequence – none temporal relationship is identified – so this is also a hypothetical ellipsis.

The sequence S6 involves temporal matters, but does not provide sufficient evidence to establish some precise relation with other sequences. In S6 it is introduced the woman who publicly spoke (Cristina), contrary to what she said in S3, in the sequence S6 she takes drugs. The spectator can choose between two possibilities:

a- Cristina takes drugs again – in S6 there is a jump forward in the story; or
b- the sequence S6 refers to images of the past, when Cristina was ill and took drugs – there is a jump back in the story.

The spectator has no other clues to choose between the alternatives a) and b) – then he puts the sequence S6 between the hypothetical ellipsis. In S7 it is shown a woman (`Px`) arguing with a doctor because she wants to become a mother. `Px` reports that she has a sick husband (as I will better discuss in chapter 7 it is a kind of weak inference, because in the story it has already been introduced a man in a hospital) – the spectator might make the assumption that the man is the woman's husband, but from a point of view of possibility to anchor events, not even this sequence provides clues to the spectator.

Finally the sequence S8 stops this long series of hypothetical ellipsis and allows the spectator to aggregate events. In fact in the sequence S8 there are events that are believed by the spectator as a causal continuation of the sequence S4 (the priest asks Jack Jordan "how did it go?" referring to the meeting of Jack with a young in S4). For the causal rule (which will be repeatedly involved in this book) when an event `E1` causes another event `E2` then the `E1` event precedes `E2`. In this case the spectator believes that the events `E7i` precede the events `E8i` in the sequence S8 (`bel(Spx,prec(E7i,E8i))`).

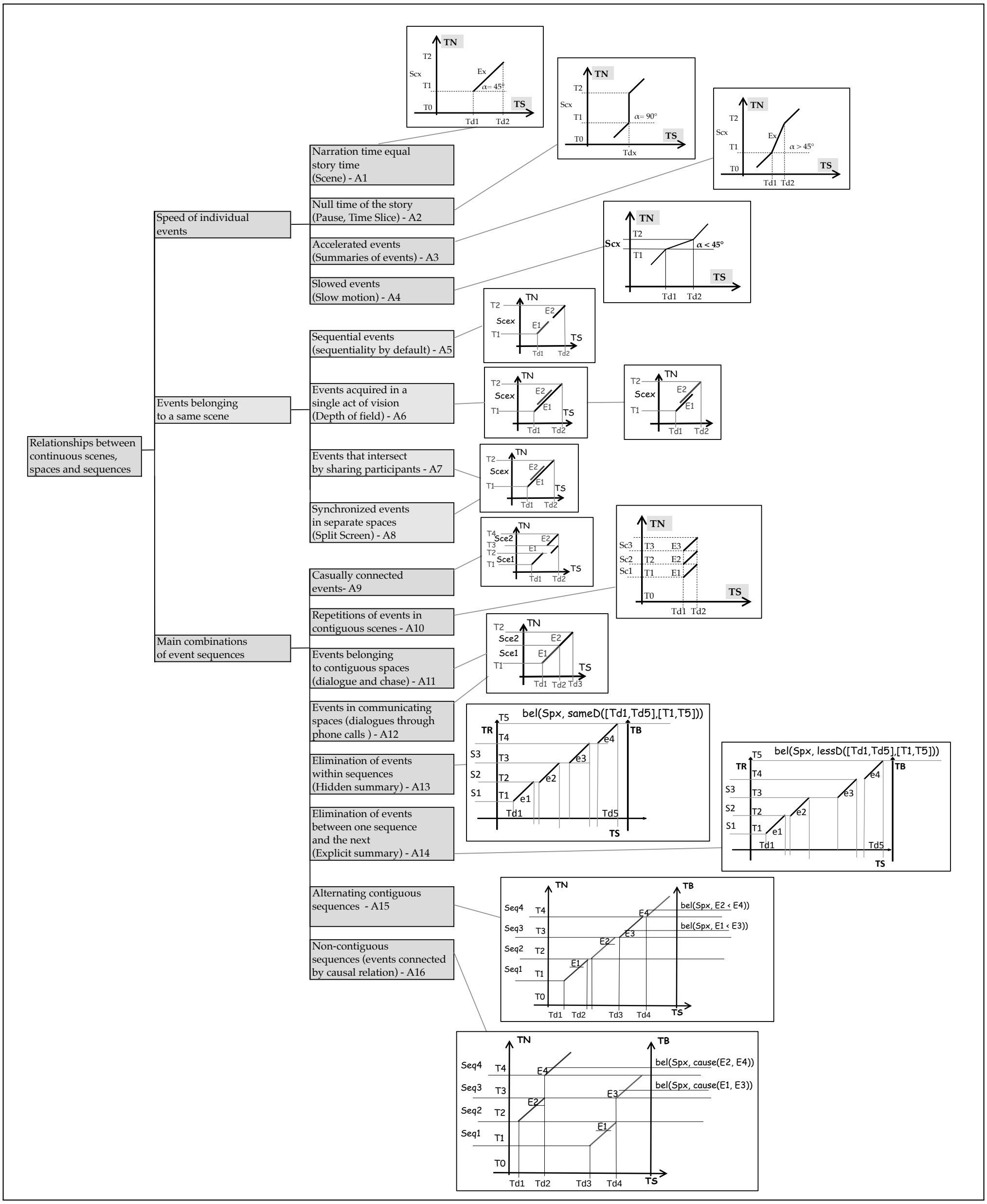


Figure 3.6.7: Summary of the relationships among scenes, spaces and sequences

3.7 SUMMARY OF THE RELATIONSHIPS AMONG SCENES, SPACES AND SEQUENCES

In this chapter I have shown a cognitive theory of the relations between the time of narration and the time of story, built through the temporal beliefs of the spectator. Through the diagrams TN-TS-TB it is possible to characterize the events of the narration and those of the story – I have separated three main categories of relations: the speed with which a single event has compared to the time of narration, the order of events occurring in the same scene, and the ways in which the events are distributed in a sequence or among multiple frequencies. The three categories I have just described are reported in the summary table in figure 3.6.7.

Part III

Stories temporal anchoring

4 FLASHBACKS AND FLASHFORWARDS

As I have shown in the previous chapter narrative ellipsis present an absence of causal connection between the current event with (at least) another event in the story – these lack of connection have the scope of creating an expectation state of causal explanation in the spectator. Flashbacks and flashforwards instead, don't generate expectations and have the scope to provide an enrichment to the story with events collocated in the past of a character's life. The basic idea I present in this chapter is to consider flashbacks and flashforwards as structural elements that can be locally identified when they are found in the telling. In this book a condition that often recurs, in the definition (in cognitive terms) of the narrative figures, regards *the locality*. In a traditional vision, the flashback is seen as a figure that contemplates, not only a going back in the story, but also its return to the story present.

I belief this meaning has the serious inconvenience that some flashback forms, especially in the contemporary cinema, can not be identified and therefore classified. This happens because taking into account also the part of the story regarding the return to the story present (the fitting phase of break of the story), would involve a such very big number of events that would interest the whole story. In such cases the flashback (that can be defined locally) is considered a structural phenomenon of the whole story of the movie.

By writing this I don't sustain that the macrostructures of the stories of the movies cannot be studied and classified (see chapter 7), but that is necessary to understand which elements of a structure in a movie can be associated to local cognitive phenomena, and which to the global phenomena of a story.

In this chapter I am going to report a representation of flashbacks and flashforwards as local phenomena that happen between two visually contiguous events – I will extend this model in the chapter 7 introducing a notion of locality, that pertains to the macro events.

4.1 A PRELIMINARY DISCUSSION ABOUT ANCHORING CATEGORIES

I begin my discussion by noting that in literature it exists, regarding some flashbacks (flashforwards) and analepsis (prolepsis) categories, a **terminological hole**, perceived and manifested by important theorists of the cinema-Chatman[1] writes:

> In the traditional cinema the term ”flashback” means a narrative passage that "goes back" in a strictly visual way, as autonomous scene, introduced by a clear sign of transition such as a break or a fade out. It is not right to refer to the traditional passages by using the term ”flashback”. Flashback and flashforward are only typical examples that regard the cinema referring to those wider classes that are analepsis and prolepsis.

It is evident that Chatman’s idea is to confine flashbacks and flashforwards in a specific category – also if the author himself doesn’t give for them a detailed definition. Others authors[2] have individuated in the *evocation* concept a crucial notion to discriminate flashbacks and flashforwards from the analepsis and prolepsis:

> When we speak about flashbacks, or flashforwards – or about the representation of a future event, a forward jump followed by a return to the present of the story – we refer to the audiovisual representation of a past or future episode. Anyway the past moments of a story, can be for example, simply evoked also simply on the sound level – through the telling of a diegetic narrator: the images represent an actual situation while words evoke a past episode. In this case I have to renounce to the terms flashback and flashforward – that are linked to the presence of the images – and recur to the ones wider, of genettian matrix, of analepsis – the subsequent evocation of a past event – and prolepsis – the telling with anticipation of a future episode. The flashback is so a particular kind of analepsis, while flashforward is a particular kind of prolepsis, anyway analepsis are not only flashbacks and the prolepsis are not only flashforwards.

1 [Chatman2010] p. 64.
2 [Rondolino2011] p. 31.

At this point it is clear that the previous definitions pinpoint in the analepsis, or prolepsis, a super category for the sub categories flashbacks and flashforwards, and for other sub categories without a name (remembering the utterance “analepsis are not only flashbacks and prolepsis are not only flashforwards”). In the these last I have identified a relevant class of figures that regard the temporal anchoring I named *temporal evocative deixis* (I will discuss specifically about evocative deixis in chapter 5)[3].They are temporal anchoring deriving from causal relations or by characteristics of the characters in the story. For example, an event E1, regarding the story of a character P1, ”when young”, happens always after an event E2 of the same character P1 ”when old’; or, ”a living character” is an event that has to happen in the the story always before of another events ”character dying”. These relations determine, in the cognitive state of the spectator, beliefs on the temporal order of the events – such $bel(Spx, prec(E1, E2))$ – and often are used from the spectator for linking events after an interruption of a story, as it happens in the flashbacks and flashforwards phenomena.

For the discussion that follows I anticipate three basic categories of the temporal evocative deixis that will be discussed in detail in chapter 5:

- an evocative deixis for repetition of events (figure 4.1.1c) happens when in the narration interval [T1-T2] it is reported an event E1 (a person

3 Generally the term ”Deixis” in linguistic [Bertinetto1991] has the following meaning:

> deixis is that linguistic phenomenon according to which determined expressions to be interpreted, ask for the knowledge of particular contextual coordinates that are identity of the participants to the communicative act and their spatial-temporal collocation.

Or also (fount www.wikipedia.org):

> In linguistics, deixis refers to words and phrases that cannot be fully understood without additional contextual information. Words are deictic if their semantic meaning is fixed but their denotational meaning varies depending on time and/or place. Words or phrases that require contextual information to convey any meaning – for example, English pronouns – are deictic.

Always in linguistic context in the specific the term ”temporal deixis” I refer to the relation existent between the time interval, in which the sentence has been uttered and the time of occurrence. My meaning of temporal deixis, beyond to contemplate the relation between the time of enunciation and time of occurrence, comprehends also the beliefs on temporal relations born in the spectator after the activation of inferences between two diegetic events also far on the narration axis.

who has suffered after an accident, a kiss between two persons, a party among friends, the death of a person and so on), and in a subsequent narration interval – $[T3\text{-}T4]$ – (after have shown other diegetic events) it is reported an event $E2$ that constitutes a repetition of the event $E1$ (in this definition, it doesn't interest if $E1$ is repeated by a different point of view). The event $E1$ in this case is clearly evoked by $E2$, which doesn't interrupt the story, that is telling at that moment (a famous evocative deixis for repetition of events, is that of rubbery in the bar, in the final sequence of the movie *Pulp Fiction*);

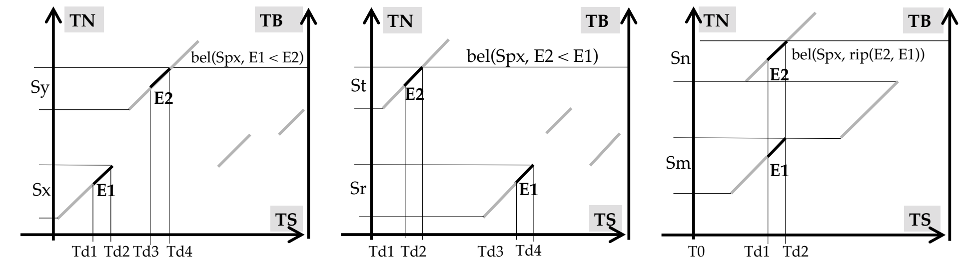
- a proleptic evocative deixis (figure 4.1.1a) happens when an event $E2$ reported in narration interval $[T3, T4]$, evokes an event $E1$ shown in the diegesis in an interval $[T1, T2]$ – without that $E2$ interrupts the story. It is the case, for example, of stories that are interrupted by an event $E1$ and, after various other happenings, are retaken, and the spectator believes that $E1$ has caused $E2$ – $(bel(Spx, cause(E1, E2))$ – (a proleptic evocative deixis is present in the initial part of the movie *The English Patient*[4];

- an analeptic evocative deixis (figure 4.1.1b) occurs when the spectator believes that an event $E2$ evokes another future event $E1$, presented before in the diegesis of the telling. This case regards for example all those narrative figures, where a story goes back in time in a part of story containing an event $E2$ (or more events) constituting an explanation for $E1$.

The cases shown contemplate all the temporal evocation deixis, obviously such deixis are staging in many different modes – but I shall discuss about it in the next chapter.

The inserting of a new category (the temporal evocative deixis) as figure of temporal anchoring has permitted us not to renounce to the traditional notions of flashback and flashforward. I have built a taxonomy of anchoring types, that have in the ellipsis, flashback-flashforward and evocative deixis the principal categories (see figure 4.1.3). The methodology of analysis adopted is

4 *The English Patient* [EnglishPatient] has been directed by Anthony Minghella – it is one of the movies most awarded in the history, 9 Oscar in 1997 (best Director for Minghella and Best Supporting Actress for Juliette Binoche)



(a) evocative proleptic deixis **(b)** evocative analeptic deixis **(c)** deixis for repetition

Figure 4.1.1: Three main categories of deixis

similar to the one of the *Formal Concept Analysis*, already used for the individuation of the ellipses classes in paragraph 3.6. To individuate the taxonomy, I have considered every temporal anchoring figure (or disanchoring) expressed through a relation of type:
analpsis(E2, E1), flashback(E2, E1), implicite-ellipsis(E2, E1),..., and so on), where E2 is the event of the story present in the current segment vision of the movie that activates the anchoring. The definitions of the attributes are the following:

A1 - the events E1 and E2 are visually contiguous or belong to macroevents[5] that are visually contiguous;
A2 - between E1 and E2 there is an interruption (break) of the story, or an unexpected change of characters and place in which the story takes place (on the notion of break I give a formal model in chapter 7);
A3 - the event E2 is not directly enunciated in the story, but it is evoked through a character's act of saying, or reported in a photo, or has some similarities with an event already seen in the story;
A4 - the event E1 precedes the event E2 in the story;
A5 - the event E2 precedes the event E1 in the story;
A6 - the event E1 happens in the same time interval of E2;
A7 - there isn't causality between E1 and E2.

Table 3 reports (in natural language) horizontally the attributes A1,. . . , A7, and vertically the names of the categories to compare. The symbol "y" indi-

5 For a formal definition of macroevent see chapter 7

CATEGORIES	A1	A2	A3	A4	A5	A6	A7
Analepsis	y/n	y/n	y/n		y		
Prolepsis	y/n	y/n	y/n	y			y/n
Evocative analeptic deixis			y		y		
Evocative proleptic deixis			y	y			y/n
Evocative deixis for ripetition			y			y	
Flashback	y	y			y		
Flashforward	y	y		y			y/n
Esplicit ellipsis	y	y		y			y
Implicite ellipsis	y	y		y			y
Hypotetical ellipsis	y	y					y

Table 3: Analysis of categories: analepsis, prolepsis, deixis, and ellipsis

cates that the category possesses the attribute, the white box doesn't possess it, and the symbol "y/n" that could possess or couldn't possess it. It is necessary to remember that the analysis we are following is based on the criterion that entities that have the same attributes pertain to the same classes, and if they have a group of common attributes, belong to the same super-category.

Table 3 can bring to different taxonomic solutions, depending by which groups of attributes I take into consideration. In particular I proposed two taxonomies that are both compatible with the criteria above mentioned. In the first I have put to center of the analysis, the analepsis and the prolepsis (see figure 4.1.2). This first taxonomy reflects the thought the theorists as Chatman, Rondolino, Tomasi and G. Genette (also if this last one doesn't explicitly pronounce himself about the flashbacks and flashforwards). The attributes $\mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2}))$ and $\mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E2}, \mathsf{E1}))$ characterize the prolepsis and analexis, and in this interpretation: (1) analexis is a super-class having as subclass flashback, analeptic deixis and ellipsis, while (2) prolexis have as subclasses flashforward, proleptic deixis and proleptic ellipsis, and at last (3) analeptics and proleptic don't constitute the more general classes of temporal anchoring, as the evocative deixis for the repetition of events aren't nor analepsis nor prolepsis, likewise the hypothetical ellipses do not belong at group of this last categories, because in the moment that they are presented, the temporal relation between the events $\mathsf{E1}$ and $\mathsf{E2}$ is not defined.

The taxonomic diagram in figure 4.1.2 evidences, that the classes analepsis and prolepsis can't be considered as "wider" categories, as they, as referred into point (3), don't include important anchoring categories as the repetition of events and hypothetical narrative ellipsis. Moreover, the same diagram put into evidence that the analepsis and prolepsis classes, are characterized only by the attribute – $\mathtt{bel(Spx, prec(E1, E2))}$ or $\mathtt{bel(Spx, prec(E2, E1))}$, these latter are abstract and of little significance to represent what happens temporally in the diegesis – as delegate to their subclasses important qualities regarding the interruption (or not) of the story, or even the existence (or not) of a causal rule.

In conclusion I believe prolepsis and analepsis categories are little useful for the temporal analysis of a story – as little characterized. In this argumentation I add also the wrong and widespread use that in the frequent analysis of the movies stories has been made, that has contributed to the big terminology confusion that has been created, especially with the categories of flashbacks and flashforwards. Moreover there is an important implication – of methodological order – in a correct taxonomical classification the repetition of events cannot be considered as singular separated category – as it has some attributes that are shared with other important categories. The con-

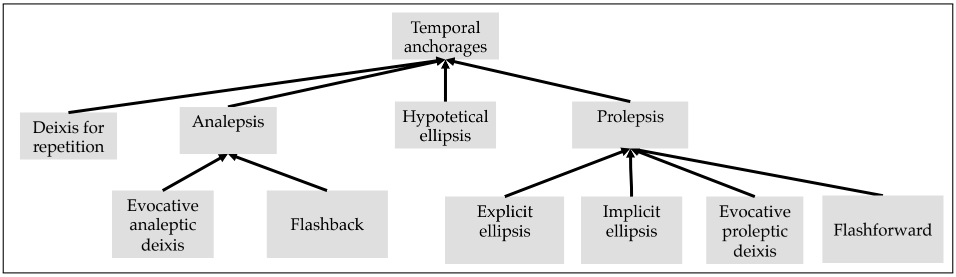


Figure 4.1.2: Taxonomy based on Analepsis and Prolepsis

sideration till now reported, it have suggested a new interpretation of table 3 consisting in giving preference to those categories to be inserted in the taxonomy having a higher number of attributes, in the way each category is well characterized. With this prerogative the ellipsis and flashbacks-flashforwards are similar, as both the figures interrupt the story, and both are generated by two events visually contiguous. Notwithstanding the categories of ellipsis and flashbacks-flashforwards are structurally similar, they have some substan-

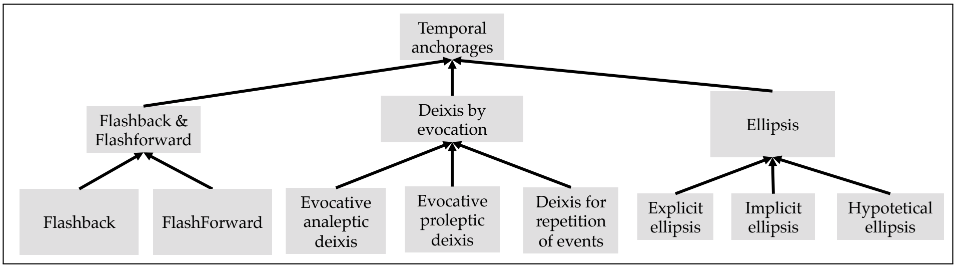


Figure 4.1.3: Taxonomy based on Evocative deixis, Flashback-Flashforward and Ellipsis

tial differences: ellipsis are strongly characterized among the involved events, while flashbacks and flashforwards have not this characteristic.

Always observing the table 3, we can note that the evocative deixis is a category of anchoring well characterized – above all because it does not interrupt the story, and in addition because the evoking event and the evoked event can be anchored far on axis TN of the narration. In a so made analysis, it is redundant to insert the categories of prolepsis and analepsis in the taxonomy.

There is another motivation that made us prefer a taxonomy centered on Evocative Deixis, Flashback-Flashforward and Ellipsis, it is the one (as I will show in detail in the following chapters) that this choice permits us to subdivide the temporal analysis of the story, in two different categories: a first regarding the breaking (fragmentation) of the temporal axis (pertaining to the ellipsis and to flashback-flashforward); and a second category regarding the fitting after the fragmentation (pertaining to the temporal evocative deixis).

Having proposed a new arrangement of the categories, in the top level of the taxonomy, I go on in this chapter in the discussion of flashback/flashforward subclasses (in the following chapter I will give the ones relating to deixis). I have schematized the flashbacks -flashforwards (see figure 4.1.4) in three big categories: narrative, by thought and by words. The flashback by thought (also named diegetic or internal) regarding introspections, remembrance or introspective telling of a character. Narrative (also named external) flashbacks and flashforwards don't predict a passage through character's point of view, and are realized only through the images content. Flashbacks by words happen through extradiegetic voices, or captions in natural language, that provide indications on the temporal order of events.

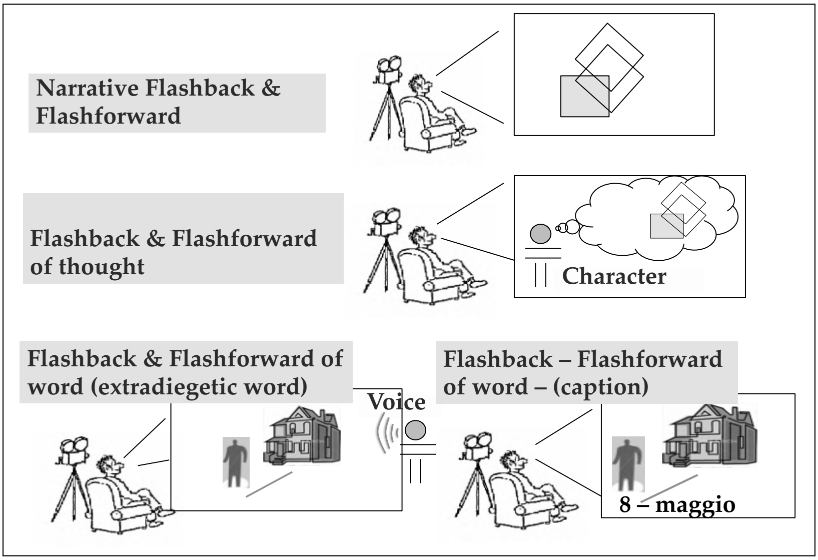


Figure 4.1.4: Flashbacks: narrative, ”of thought” and ”of word”

There are some important subcategories of narrative flashbacks -flashforwards that are staged through the presence of calendars or clocks inside of the diegesis.

Among the subcategories of narrative flashbacks there are also that use the colour (generally black or white for the past, colour for present)[6]. They exist also flashbacks (flashforwards) of thought that adopt the colour as instrument of temporal anchoring, but are rare.

4.2 NARRATIVE FLASHBACKS AND FLASHFORWARDS

In this paragraph I present some cognitive models of narrative flashbacks, or figures of the narration presenting backwards temporal jumps in a story, without making use of captions, extradiegetic voices or the remembering of some

6 Y. Moreun has written a monograph in which analyses the possible usages of the colour in the movies stories. Particularly in [Mouren2012] I report a classification of the different flashback kinds, in which the color is used in a story to induce the spectator to execute temporal anchoring.

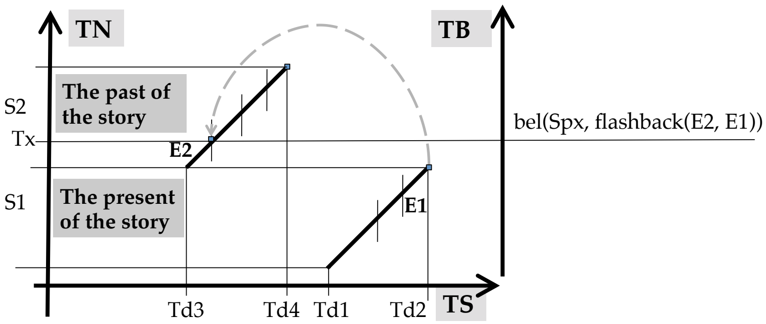


Figure 4.2.1: Flashback represented by TN-TS-TB diagrams

characters. Many of the concepts here presented are employed also for the construction of flashback models of thought, and flashbacks of words (extradiegetic voice or captions).

From a cognitive point of view, a flashback occurs in the correspondence of an event $\mathsf{E2}$, reported in the narration visually after an event $\mathsf{E1}$, in which the spectator believes that $\mathsf{E2}$ happens before $\mathsf{E1}$ in the story. There are several ways for a flashback to be staged – I report some cases that often are present in the stories of movies.

NARRATIVE FLASHBACK. All the kind of flashbacks happen between two events $\mathsf{E1}$ and $\mathsf{E2}$ that the spectator believes they belong to the same story. The simpler form of flashback is the one in which $\mathsf{E1}$ and $\mathsf{E2}$ are visually contiguous (see inference 3.2.3) and has the following inference: Spx believes that $\mathsf{E2}$ is a flashback of $\mathsf{E1}$, if Spx believes that: $\mathsf{E1}$ and $\mathsf{E2}$ belong to same story; $\mathsf{E1}$ and $\mathsf{E2}$ are visually contiguous; and $\mathsf{E2}$ precedes $\mathsf{E1}$ in the story. Formally:

$$\begin{aligned}&\mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{flashback}(\mathsf{E2},\mathsf{E1}))) \qquad \leftarrow\\ &\ \mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{sameStory}(\mathsf{Str},\mathsf{E1},\mathsf{E2}))),\\ &\ \mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{visContiguous}(\mathsf{E1},\mathsf{E2}))),\\ &\ \mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{prec}(\mathsf{E2},\mathsf{E1}))),\mathsf{story}(\mathsf{Str}).\end{aligned} \tag{4.2.1}$$

The relation $\mathsf{bel}(\mathsf{Spx},\mathsf{prec}(\mathsf{E2},\mathsf{E1})$ is acquired from the spectator through cognitive inferences regarding temporal aspects relating to characters, places, and captions containing time. These inferences constitute the *inferential re-*

sources possessed by the spectator to execute temporal anchoring of the story events – I have dedicated the chapter 5 of this book to these cognitive inferences, that I have called temporal deixis.

In figure 4.2.1 I have indicated as *flashback point* the temporal instant of the narration in which the story goes back.

NARRATIVE FLASHBACK WITH DELAY IN THE RECOGNITION OF THE FLASHBACK. To individuate between two events $E1$ and $E2$ a narrative flashback (without being present captions or extradiegetic voices giving temporal references or also a remembrance of some characters) it is necessary that a short interval of the narration has to be spent (see figure 4.2.2), in order that the spectator could infer, by events shown in the diegesis, a going back of the story. Then the spectator has to execute some inferences, of deiptic nature, to believe that $E2$ precedes $E1$[7].

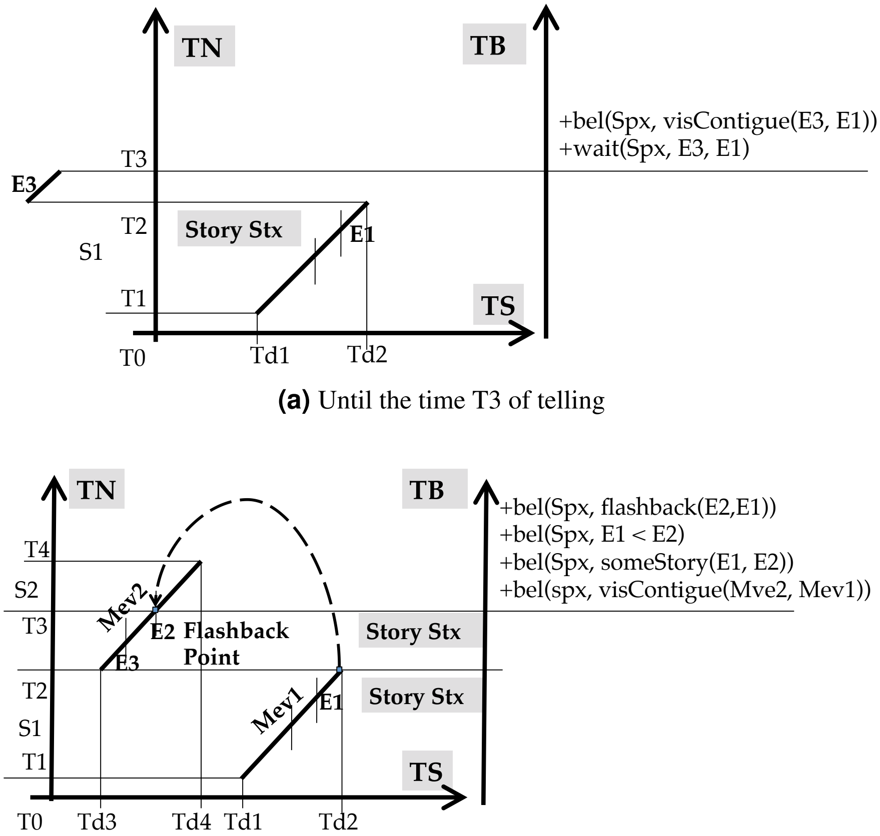
However, in many stories the event $E2$, responsible of the inference of going back, *comes late* in the narration. As I will report in the following, the essential condition is that the event $E2$ belongs to the macro event (see chapter 7).

To let this typology of flashback figures (very frequent), I have to consider another more general inference, by substituting in 4.2.1 the condition

$$bel(Spx, visContigue(E1, E2))$$

with $mev(Tx, bel(Spx, visContigueMev(Mve1, Mve2)))$ is the condition of visual contiguity between two macro events $Mve1$, $Mve2$ to which $E1$ and $E2$ respectively belong. In this way, the inference 4.2.1 is transformed into: Spx believes that is a flashback of $E1$ if Spx believes that: $E1$ happens, $E2$

7 In the model proposed I have not taken into account anticipation mechanisms of the spectator - in this way the event that actives an flashback has to be shown (completely) in the diegesis. For anticipation mechanisms see [Miceli2015]



(a) Until the time T3 of telling

(b) Until the time T4 of telling

Figure 4.2.2: Delayed recognition of flashback in the story

happens, $E1$ belongs to macroevent $Mev1$, $E2$ belongs to macro event $Mev2$, $Mve1$ and $Mve2$ are visually contiguous, and $E2$ precedes $E1$.

$$\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{flashback}(E1, E2))) \leftarrow \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, E1)), \mathit{mev}(Tx, \mathit{bel}(Spx, E2)), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{sameStory}(Str, E1, E2))), \mathit{story}(Str), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{belongMev}(Mev1, E1))), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{belongMev}(Mev2, E2))), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{visContiguousMev}(Mve1, Mve2))), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{prec}(E2, E1))).
\end{aligned} \tag{4.2.2}$$

NARRATIVE FLASHFORWARD. Some dictionaries, related to the cinematographic field, define the flashback as a figure of narration described as the modality in which the story return to the past, together to all the past events allows the story the returning to the present. My prerogative to characterize each figures of the telling – as local phenomenon – has brought us to characterize the flashback with a statute of cognitive phenomenon well localized in the time of story, independently as it comes back to the *present of the story*. For this reason, I consider the flashforward, just as the flashback, as a local phenomenon regarding only the modality in which the story gets back to the present. In this way the cognitive inference for a flashforward is the following: Spx believes that $E2$ is a flashforward of $E1$ if Spx believes that: $E1$ happens; $E2$ happens; $E1$ and $E2$ belong to same story; $E1$ and $E2$ is visually contiguous; and $E1$ precedes $E2$.

$$\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{flashforward}(E1, E2))) \leftarrow \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, E1)), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, E2)), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{sameStory}(Str, E1, E2))), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{visContiguous}(E1, E2))), \\
&\;\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{prec}(E1, E2))), \mathit{story}(Str).
\end{aligned} \tag{4.2.3}$$

A flashforward, as a local phenomenon, could be easily confounded with the ellipsis. We remember that these latest figures have a specific condition in the lack of causality among the events visually contiguous. A flashforward can be distinguished from an ellipsis as it doesn't leave a void in the story to be explained.

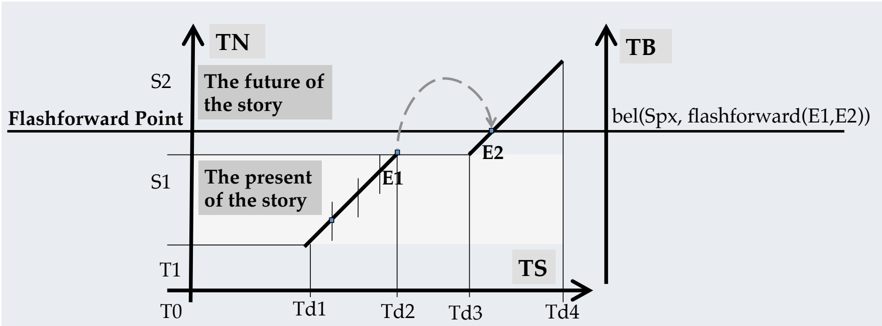


Figure 4.2.3: Flashforward represented by a TN-TS-TB diagram

4.3 FLASHBACKS AND FLASHFORWARDS OF THOUGHT

For the categories of figures that are a remembrance (flashback) or of a future projection (flashforward) of some characters, I adopted the locution ”flashback of thought” because both ”diegetic flashback” or also ”internal flashback” terminologies, commonly used in cinema theories, could create some ambiguities – being the term “diegetic” used for every entity belonging the diegesis and ”internal” a too much generic term that needs other attributes/adjectives to distinguish themselves by other diegetic entities.

FLASHBACKS OF THOUGHT. From the analysis reported before, it results that the flashbacks (flashforwards) are represented in the filmic texts in two consecutive events, through a cognitive codified pattern (remembrance, dream and so on) that induce the spectator to collocate in the past (or in the future) events present in the current filmic enunciation.

For the flashback of thought (in particular through a remembrance) I report a model based on analytical couples formed by what the filmic text shown, and the correspondent spectator's cognitive state. I present in a prototypal form the analysis of a filmic segment present in *Incendies*[8])

My analysis starts considering the flashback of thought as a particular subjective of a character Px, that instead of directing his glance on objects of the

8 *Incendies* is a movie by Denis Villeneuve interpretated by Lubna Azabal (Nawal Marwan) and Mélissa Désormeaux-Poulin (Jeanne Marwan) [Incendies]

world that surround him, opens a seeing on facts that exist in his remembrance of events in the past. My model of flashback is formed of (all) cognitive components that I report as follow:

F1 - object, place or triggering – In the scene an event $\mathsf{E1}$ (an object, a place, an act of word) is shown constituting the triggering event that actives a particular thought (a remember) of a character;

F2 - a character Px **sees an event** – $\mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{E2}, \mathit{see}(\mathsf{Px}, \mathsf{E1})))$;

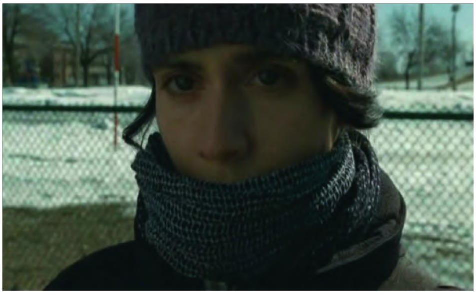
F3 - it is near framed the face of a character Px – Px's eyes don't point to any event or object of his diegetic space (gaze empty), in addition the character's head is framed by close – this in the spectator gives rise to the belief that the events, which will immediately follow on the screen, happen in the mind of character Px. After the phase $\mathsf{F3}$ the following cognitive situation holds: a visual act about events Ex and Ey happens; the spectator Spx believes that: Px is a participant in the event Ex; Az is the action of Ex, Az action shows the face of Px; mode of Az is show up close Px; in Ey, Px looks at in vacuum.

$$\begin{array}{l}
\mathsf{visAct}([T1, T2], Spx, Segx, [Td1, Td2], [Ex, Ey]). \\
\mathsf{prec}(T2, Tx). \\
\mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{who}(Ex, Px))). \\
\mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{what}(Ex, Az))). \\
\mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{sameA}(Az, \mathsf{show}(\mathsf{face}, Px)))). \\
\mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{propAz}(\mathsf{mode_show}, Az, \mathsf{up_close}))). \\
\mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{what}(Ey, \mathsf{look}(Px, \mathsf{vacuum})))).
\end{array} \tag{4.3.1}$$

The situation described in 4.3.1 is a kind of cognitive state in which the spectator expects a character Px to remember "something".

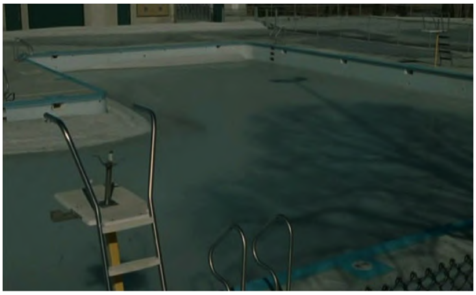
F4 - Transition - there is a strong transition (generally a strong marked fade-out);

F5 - A new event Ev **in a different spatial-temporal context is reported.** The state of expectation 4.3.1 leads the spectator to believe that the event Ev



(a) Px looks in vacuum (F3)

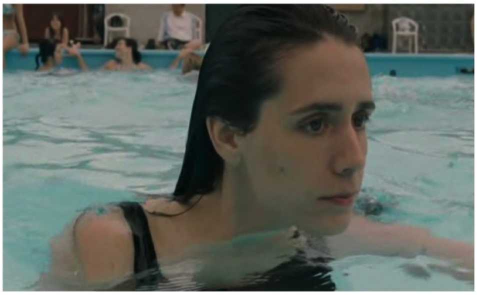
(b) Px looks at an object in a place (F2)



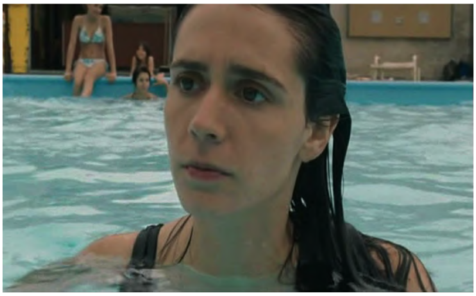
(c) Trigger vision (F1)

(d) Transation (F4)

(e) Event in Wrx (F5)



(f) Event in Wrx (F5)



(g) Event in Wrx (F5)

(h) Temporal deixis (F6)

Figure 4.3.1: Flashback of thought in *Incendies*

shown in the diegesis $visActWt([Tx, Ty], Spx, Segx, [Tdx, Tdy], Az, Ev)$ is a memory of Px.

$$
\begin{aligned}
&mev(Ty, bel(Spx, sameA(Az, remember(Px, Ez)))) \leftarrow \\
&\quad mev(Tx, bel(Spx, who(Ex, Px))), \\
&\quad mev(Tx, bel(Spx, what(Ex, Az))), \\
&\quad mev(Tx, bel(Spx, sameA(Az, show(face, Px))), \\
&\quad mev(Tx, bel(Spx, propAz(modeShow, Az, upClose))), \\
&\quad mev(Tx, bel(Spx, what(Ey, look(Px, vacuum)))), \\
&\quad mev(Tx, bel(Spx, fadeOutx)), \quad \text{\% There is un fade-out contiguous} \\
&\quad mev(Tx, bel(Spx, visContiguous(Ey, fadeOutx))), \quad \text{\% to } Ey \\
&\quad visActWt([Tx, Ty], Spx, Segx, Az, Ev)), \\
&\quad diegeticEvent(Ev), diegeticEvent(Ez), time(Ty).
\end{aligned}
\tag{4.3.2}
$$

It holds also the rule that the spectator Spx believes an event Ex has believed to happen by a character Px if Spx believes that Px believes Ex has happened.

It is valid also the rule that the viewer Spx believes that a character Px believes an event Ex occurred if Spx believes that Px remembers that Ex has happened.

$$
\begin{aligned}
&mev(Tx, bel(Spx, what(Ev, bel(Px, Ez)))) \leftarrow \\
&\quad mev(Tx, bel(Spx, what(Ex, remember(Px, Ez))))), \\
&\quad mev(Tx, who(Ev, Px)).
\end{aligned}
\tag{4.3.3}
$$

The condition $mev(Tx, bel(Spx, what(Ev, bel(Px, Ez))))$ is the characterizing mental state for the flashback of thought[9].

F6 - Temporal deixis – an event Ez reported in the diegesis (remembered by the character Px) generates a temporal deixis, and in such a way allows to the spectator to acquire the belief ($bel(Spx, prec(Ez, Ey))$) on the temporal order between an event Ez and an event Ey that frame the character Px. The

9 It is useful and more expressive using the following position:

$$bel(Spx, bel(Px, Ez)) =_{def} bel(Spx, what(Ev, bel(Px, Ez))), diegeticEvent(Ez).$$

to represent the inner belief of a character Px.

cognitive activity that brings to the acquisition of this belief[10] is activated by putting on stage, in this case some remembrances of events, in general in reporting different periods of character's life (as teenager, adult, older and so on) and by these the spectator infers if the story has gone into the future or back into the past.

These latest are examples of how the belief $\mathsf{bel(Spx, prec(Ez, Ey))}$ can be generated, but this belief can be acquired in many other ways from the spectator – in the model shown anyway these different modalities don't impact beliefs and inferences of the other phases F1, F2,..., All the cognitive components F1, F2, F3, F4, F5 e F6 written above, constitute the conditions (in the cognitive state) that let the spectator to infer that we are in presence of a story remembered by a character (a flashback of thought). The model for such a flashback is represented by the following cognitive rule: Spx believes that Ez is a flashback of Ey if Spx believes that: Px believes that Ez happens; Ey and Ez are visually contiguous; and Ez precedes Ey.

$$\begin{aligned}&\mathsf{mev(Tx, bel(Spx, flashback(Ez, Ey)))} \leftarrow\\&\quad\mathsf{mev(Tx, bel(Spx, bel(Px, Ez))),}\\&\quad\mathsf{mev(Tx, bel(Spx, visContiguous(Ey, Ez))),}\\&\quad\mathsf{mev(Tx, bel(Spx, prec(Ez, Ey))).}\end{aligned} \tag{4.3.4}$$

The six-steps model above reported, catches different kind of flashbacks, however flashback of thought can build a different order of presented model. I underline that the order can change, but its components are all present. For instance, in *Incendies* the order of the narration is the following: F3, F2, F1, F4, F5 and F6 (see figure 4.3.1).

With the given model we can represent the filmic segment present in *Jesse Stone The Innocents* (see figure 4.3.2).

In this film there is a sequence that begins in a jail cell (figure 4.3.2a), where a woman says to Jesse "you aren't anymore the chief of police" (Ea)[11]. The spectator comprehends that the story comes back because in a following scene Jesse says (Eb), "I am the chief of police" (figure 4.3.2b) (this

10 This type of inference is a temporal deixis for evocation. On this topic I will talk in detail in the next chapter

11 The inference activated by the spectator is that: a character says that has happened an event Ex; then the spectator believes that Ex have been occurred (see inferences that I will present in the paragraph 5.5.1).

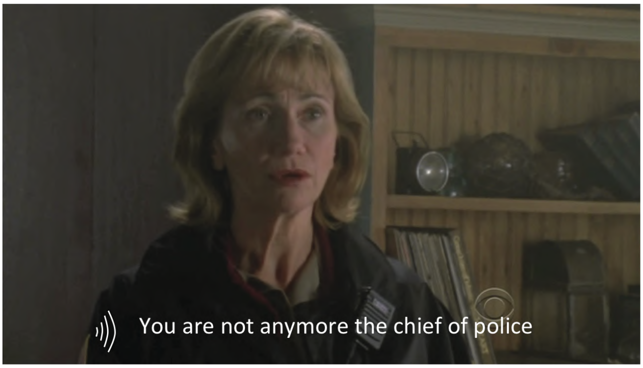
means that Jesse was the chief of police in the past). The verbal tenses of two events Ea and Eb permits to the spectator to acquire the belief – $bel(Spx, prec(Eb, Ea))$ – on the temporal order of events Ea and Eb In a third event Ec, successive in the telling to Eb, is shown Jesse driving a car and where the story reveals that Jesse, in a state of semi sleep had only imagined the happening of events Ea and Eb.

In the example just reported, we observe that the phase of the temporal deixis $F6$ is antecedent to the one of transition from reality to the sleep $F1$, $F2$ and $F3$.

FLASHFORWARDS OF THOUGHT. The model given for flashbacks of thought can be used, with some modifies, also for flashforwards of thought. The part of the model represented by the steps $F1$, $F2$ and $F3$ by the inference, remains valid without any variation for a flashforward of this kind. Indeed this part regards the acquisition of the belief that the events, appearing within the diegesis, are the one that *flows* in the mind of a character, and this activity is common both to flashbacks of thought and to flashforwards of the same kind. The difference between these last figures consists in the belief on the temporal order which in occasion of a forward jump of the story (a flashforward), I have to insert the belief $mev(Tx, bel(Spx, prec(Ey, Ez)))$. In this way, the analogous inference of the 4.3.4 is the following: Spx believes that Ez is a flashforward of Ey if Spx believes that Px believes that: Ez happens; Spx believes Ez happens; Spx believes Ey is visually contiguous to Ez; and Spx believes Ey precedes Ez.

$$\begin{aligned}&mev(Tx, bel(Spx, flashforward(Ez, Ey))) \leftarrow\\&\quad mev(Tx, bel(Spx, bel(Px, Ez))),\\&\quad mev(Tx, bel(Spx, visContiguous(Ey, Ez))),\\&\quad mev(Tx, bel(Spx, prec(Ey, Ez))).\end{aligned} \tag{4.3.5}$$

A flashforward of thought is present in *Pulp Fiction*, in the episode in which the captain Koons delivers the clock to Butch. In this case the deictic rule described in details in paragraph 5.6 ("events happening to a character when is a child, are always antecedent to the ones in which the same character is adult") it makes the condition $mev(Tx, bel(Spx, prec(Ey, Ez)))$ true.



(a)

(b)

(c)

Figure 4.3.2: Flashback by thinking in *Jesse Stone The Innocents*

FLASHFORWARD OF THOUGHT THROUGH PROJECTION IN FUTURE OF CHARACTER. A forward projection through a character's desire is a particular case of flashforward of thought. In the film stories are present many cases in which a character Px has some mental images in which he projects himself in a scenery, and in which he optimistically overcomes a certain context of difficulties in which he finds himself – or pessimistically he doesn't overcome it. I take as example for the discussion the case of *Midnight Cowboy* where the conditions $F1$, $F2$, $F3$, $F4$, $F5$ of the model provided previously are all present 4.3.3. There is a trigger "one of Rico's friends goes out with a girl" ($b1$), this event is observed by Rico (Dustin Hoffman) ($b2$). In the event that follows is shown Rico having on the face the expression of someone who is thinking ($b3$). Rico's thinking is shown in a temporal-spatial context different from the one in which Rico finds himself - Rico imagines to run on a sunny beach in Florida, while his actual condition is the one of being lame in a very cold American district. The step $b6$, in these types models, varies from a story to another, and it is the one responsible the acquisition of a relations on the temporal order among the events $E1i$ before of the projection and those regarding the beach in Florida. The spectator must be able to believe that $prec(E1i, E2j)$ ($bel(Spx, prec(E1i, E2j))$), his cognitive process in this case consists in recognize in Rico the desire to change the life negative context in which he finds himself. The spectator possesses, at time tx of the current cognitive state, the following beliefs on the character Rico:

$mev(Tx, bel(Spx, what(e1, goal(rico, when(e11, before([td1, td2])))))).$
$mev(Tx, bel(Spx, what(e1, goal(rico, what(e11, go(rico, sea)))))).$
% Rico desires to go sea
$mev(Tx, bel(Spx, what(e2, goal(rico, when(e22, before([td3, td4])))))).$
$mev(Tx, bel(Spx, what(e2, goal(rico, what(e22, go(rico, hot\_country)))))).$
% Rico desires to go to a hot country
...

(I remember that the goal constitutes the desire of an agent and so in the expression the belief of the spectator regards the desires of the character Rico). These beliefs have been acquired by the spectator in sequences preceding, the event of mental projection in the future (in a scene Rico explicitly says he want to go to the seaside). In the sequences S3 and S4 the story shows that

(a) S1 - Joe *conquest* a woman **(b)** S2 - Rico imagines

(c) S3 - Rico goes to sea and runs **(d)** S4 - Rico goes to sea and is happy

Figure 4.3.3: Projection into the future in *Midnight Cowboy*

Rico is at the seaside, in relation to the sequences S3 and S4 the spectator builds the beliefs:

$$\mathrm{bel}(spx, when(e5, on(td6, td7))). \quad \mathrm{bel}(spx, what(e5, go(rico, sea))).$$

being the events presented in the story just the ones desired by Rico, the spectator believes that what Rico is imaging is a future projection.

I report an instance of temporal deixis just described postponing to the notes the general scheme[12] spx believes that $[td1, td2]$ precedes $[td3, td4]$ if Spx believes that: $e1$ happens on $[td1, td2]$; the "what" of $e1$ – Rico desire that $e11$ happens after $[td1, td2]$; in $e11$ Rico desires to go to the sea; in $e12$ Rico imagines $e13$; $az2$ is the "what" Rico imagination; the action $az2$ is "Rico go to sea"; $[td3, td4]$ is the interval in which Rico desires $e13$.

$$
\begin{aligned}
& mev(Tx, bel(spx, prec([td1, td2], [td3, td4]))) \leftarrow \\
& \quad mev(Tx, bel(spx, when(e1, on([td1, td2])))), \\
& \quad mev(Tx, bel(spx, what(e1, goal(rico, when(e11, before([td1, td2])))))), \\
& \quad mev(Tx, bel(spx, what(e1, goal(rico, what(e11, go(rico, sea)))))), \\
& \quad mev(Tx, bel(spx, what(e12, imagine(rico, e13)))), \\
& \quad mev(Tx, bel(spx, what(e13, az2))), \\
& \quad mev(Tx, bel(spx, sameA(az2, go(rico, sea)))), \\
& \quad mev(Tx, bel(spx, when(e13, on([td3, td4])))).
\end{aligned}
\tag{4.3.7}
$$

The figure 4.3.7 gives the relation of partial order necessary to apply the inference 4.3.4. In qualitative terms, the inference 4.3.4 expresses the rule that the interval of time in which a character's desire born, is always antecedent to the temporal interval in which the desire realizes itself, or better that the character believes that is realized (in the case of the projection in the future, the character it is not sure that the desire will be realized).

---

12 The deiptic rule is the following:

$$
\begin{aligned}
& & & \text{\% Spx believes that } [Td1, Td2] \\
& mev(Tx, bel(Spx, prec([Td1, Td2], [Td3, Td4]))) \leftarrow & & \text{\% precedes } [Td3, Td4] \text{ if} \\
& mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))), & & \text{\% E1 happens on } [Td1, Td2], \\
& mev(Tx, bel(Spx, what(E1, goal(Px, E11)), & & \text{\% E11 is a desire of Px,} \\
& mev(Tx, bel(Spx, what(E1, goal(Px, - & & \\
& \qquad -when(E11, after([Td1, Td2])))))), & & \text{\% E11 happens after } [Td1, Td2], \\
& mev(Tx, bel(Spx, what(E1, goal(rico, - & & \\
& \qquad -what(E11, Az1)), & & \text{\% } Az1 \text{ is an action in E11,} \\
& mev(Tx, bel(Spx, what(E12, imagine(Px, E13))), & & \text{\% in E12 Px imagines E13,} \\
& mev(Tx, bel(Spx, what(E13, Az2)), & & \text{\% } Az2 \text{ is an action in } Az1, \\
& mev(Tx, bel(Spx, sameA(Az2, Az1))), & & \text{\% the action } Az2 \text{ is } Az1, \\
& mev(Tx, bel(Spx, when(E13, on([Td3, Td4]))), & & \text{\% } [Td3, Td4] \text{ is the interval} \\
& & & \text{\% in which Px desires E13,}
\end{aligned}
\tag{4.3.6}
$$

4.4 FLASHBACKS AND FLASHFORWARDS BY WORDS

Many kinds of narrative flashbacks and flashforwards are put on stage through an extradiegetic voice or a caption that: explicitly reports a **diegetic chronological time** (8-march-1942, 5 may and so on) that will be a temporal reference to anchor events on the axis of the story; or that enunciates a temporal order relation between an diegetic event just reported in the diegesis, with one visually contiguous (4 months after, 8 hours before and so on) to consent in the same way, anchorings (flashbacks or flashforwards) among events. For both the modalities I have to consider the examples and the categories reported in figure 4.4.1. Before showing some models for the categories of anchorage just named, I present a reformulation, in cinematographic terms, about the time of happening, enunciation and reference, existing in linguistic for the analysis of the verbal time.

4.4.1 Reichenbach's Theory of Tense for the filmic text

In linguistic, according H. Reichenbach[13], verbal time express relations among three temporal parameters: happening time or event time (Ta), time of the enunciation (Te), and time of reference (Tr). I report an example given in [Bertinetto1991]:

10 minutes after the 5, John came back home

"5" is the time of reference Tr - "came back" is the time of happening Ta and Te is the time of enunciation of the sentence[14]. In the sentence given, we can establish the following relations:

$Ta<Tr \text{ and } Tr<Te$

13 A formulation of the theory by H. Reichenbach [Reichenbach1947] referring the italian language is presented in [Reichenbach1947]

14 The study of these kind of relations, began by H. Reichenbach [Reichenbach1947] and with following contributes till the work by A. Giorgi and F. Pianesi [Giorgi1997], where the basic researches on the relations of the verbal tenses, in function of Ta, Tr and Te, have been performed.

Captions-Watches-ExtradiegeticVoice	
Calendar (diegetic or extradiegetic)	
Clock (diegetic or extradiegetic)	
Caption or extradiegetic voice with cronological time, and the enunciation of an event	At seven o'clock in the afternoon, John returned home.
Caption or extradiegetic voice with temporal adverbial, and the enunciation of an event	Ten minutes before (after) seven o'clock, John returned home.
Caption or extradiegetic voice with only a cronological diegetic time	——
Simple date or time	1940, 8 September 42, at 7 pm.
Place (only for captions)	Paris March 8 1968.
Qualitative time	The day of the robbery.
Caption or extradiegetic voice with only temporal relationship	——
Quantitative temporal adverbial	4 hours before, seven months later.
Qualitative temporal adverbial	Some time later.

Figure 4.4.1: Captions, Watches, and Extradiegetic Voices

In my formalism I have defined H. Reichenbach's temporal relations in terms of spectator's temporal beliefs regarding Ta, Te and Tr.

I begin to observe that in linguistic the three times Ta, Te and Tr have a certain ambiguity. For instance what do I intend as "time of happening"? is the temporal interval in which an action is happening, or it is the temporal instant of its beginning? The same is for the time of enunciation: is it a time interval in which an event is enunciated or the moment in which the linguistic utterance begins?

Regarding the "time of reference" there isn't any problem: it is a temporal instant – not an interval. Notwithstanding the ambiguity as both Ta and Te these latter have to be compared in a temporal analysis to Tr (that is a punctual time). For Ta and Te I chose so a representation based on temporal instant.

I begin my rewriting Reichenbach's relationship. I represent the event time of a filmic event Ex, as a relation $\mathsf{ta(Ex, Ta)}$ between a diegetic event Ex and a diegetic time Ta – this last collocated on the axis TS of the story. The event time in this way, is a diegetic time that I represent as spectator's belief – $\mathsf{bel(Spx, ta(ExTa))}$[15].

I assume that Ta coincides with the starting time ($\mathsf{Td1}$) of the temporal interval in which the diegetic event Ex happens: Spx believes that time event of Ex is $\mathsf{Td1}$ iff Spx believes that: Ex happens; and Spx believes that Ex happens on $[\mathsf{Td1}, \mathsf{Td2}]$.

$$\begin{aligned}&\mathsf{mev(Tx, bel(Spx, ta(Ex, Td1)))} \leftarrow \\ &\quad \mathsf{mev(Tx, bel(Spx, when(Ex, on([Td1, Td2]))))}, \\ &\quad \mathsf{diegeticTime(Td2)}.\end{aligned} \tag{4.4.1}$$

ENUNCIATION TIME OF FILMIC EVENT. With $\mathsf{te(Ex, Te)}$ I represent the enunciation time Te of a story event Ex, and with $\mathsf{bel(Spx, te(Ex, Te))}$ the corresponding spectator's belief. Te is the time in which the event Ex begins to be shown/uttered in the diegetic images. In order to perform com-

15 The spectator's belief of "when it happens an event" introduced till now – $\mathsf{bel(Spx, when(Ex, on([Td1, Td2])))}$ – and $\mathsf{bel(Spx, ta(Ex, Ta))}$ represent in a different form the same concept. I have introduced $\mathsf{bel(Spx, ta(Ex, Ta))}$ to have a representation that easily permits to do comparisons above all with the times of reference of events – that are punctual.

parisons with other times (time event and time reference), I also represent the enunciation time as a temporal instant, defined as follows:

$$\begin{aligned}&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{te}(Ex, T1))) \leftarrow \\ &\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{show}(Ex, \mathit{on}([T1, T2])))), \\ &\quad \mathit{time}(T2).\end{aligned} \tag{4.4.2}$$

REFERENCE TIME OF A DIEGETIC EVENT. With $tr(Ex, Tr))$ I represent the time of reference Tr of a diegetic event Ex. The diegetic time Tr is not always enunciated in the diegesis, but is often inferable in all those cases in which it is explicitly enunciated a chronological diegetic time through captions, extradiegetic voices (or diegetic voices), diegetic clocks and calendar present in the diegesis.

If a diegetic event is accompanied by a simple caption in which only an explicit temporal expression is present, as "7th May 1989", "January 1950", "Spring 1980" and so on, the spectator believes that the time of reference Tr of the event Ex ($tr(Ex, Tr)$), is just the one shown in the caption.

In figure 4.4.2 a story event shows a caption with a date: 8-april. We can suppose that in correspondence of this caption (in the cognitive space of the spectator) the belief $bel(Spx, tr(Ex, [8\text{-}april])$ is created. The diagram 4.4.2

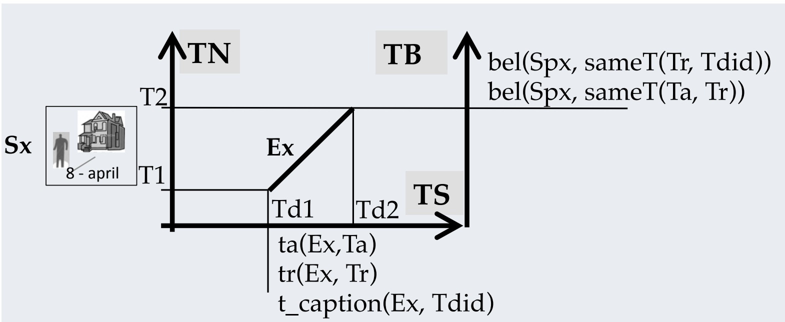


Figure 4.4.2: Time of reference represented by a caption

graphically represents a model that I will discuss in the paragraph 4.5.1.

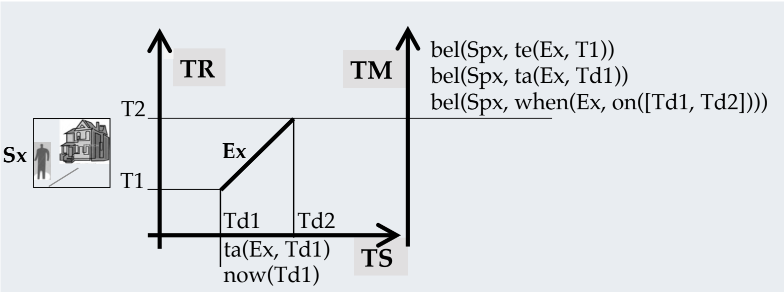


Figure 4.4.3: Time of enunciation (Te) and time of event (Ta) for filmic events

4.4.2 Caption or extradiegetic voice with chronological time and the enunciation of an event

TIME PRESENT AND TIME EVENT. I have introduced in 2.13.4 the belief $mev(Tx, bel(Spx, nowTd(Tdx)))$ representing the spectator's cognitive perception at regards the time present in the diegesis. There is an useful relation between time present and time event (time of the happening):

$$\begin{aligned}
&mev(Tx, bel(Spx, sameT(Ta, Tdx))) \leftarrow \\
&mev(Tx, bel(Spx, ta(Ex, Ta))), \\
&mev(Tx, bel(Spx, nowTd(Tdx))), \\
&diegeticTime(Ex).
\end{aligned} \tag{4.4.3}$$

The expression 4.4.3 formally means that in the filmic text, the time of the happening ($ta(Ex, Ta)$) always coincides with the present time ($nowTd(Tdx)$). The inference 4.4.3 represents in cognitive terms a well-known axiom of the cinema: **the movie is at present time**[16] a famous concept in cinema's theories.

16 This axiom is reported in [Rondolino2011] attributed to A. Laffay [Laffay1964]

4.5 EVENT TIME AND EXTRADIEGETIC VOICE

In this section I report a cognitive model regarding the relation existing between the time of the happening and the extradiegetic voice (or caption)[17], where event time is the same of reference time.

For discussion I will refer to the example shown in figure 4.5.1. In this paragraph I will arrive to some conclusions which start from the premise that in the film vision there are two channels of perception activated by the spectator: the one visual and the one auditive. This last can be composed by a voice, a music, or a noise. In this paragraph I put my attention on the voice in relation to the visual component of film[18]. I suppose then that to the spectator arrive fluxes of independent signals that he has to codificate and make them consistent in a unique unity of filmic discourse. These types of texts having more heterogeneous units that contribute, in a same interval, to a same discourse[19]. To this aim I propose an approach of analysis that initially separates

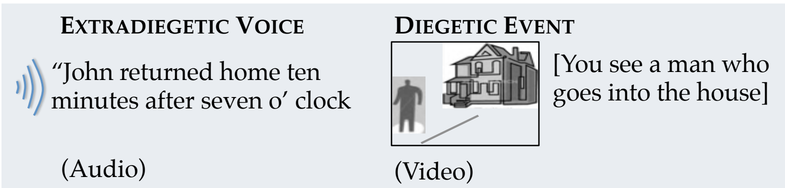


Figure 4.5.1: Example of diegetic event and extradiegetic voice as comment

17 The models I are going to present for this form of reference time, can be applicable also to the captions, although these forms of reference time in the stories are rare. A voice generally has expressions such as "Giorgio entered into the house that day at seven pm", with images showing a man entering in a house. In a caption, expressions such extensive are never adopted – but only short linguistic forms of type "at seven pm".

18 On the sound analysis in the filmic text you have to take into account a basic theoretical text of the sector [Chion2001]

19 This texts are known as syncretic texts. A definition of this last is given in [Cosenza2004]: ".. the elements necessary to define a syncretic text, elements that Greimas e Courtés (1986, voce Syncrétiques, sémiotiques) saw in the compresence inside of the same instance of utterance of "a plurality of languages of manifestation" or of many semiotic systems different among them. This definition could be re-elaborated defining a syncretic text as a text capable of organizing heterogenous languages inside of a strategy of unitary communication, provided with characteristics of cohesion and coherence that brought to the same instance of utterance."

the diegetic, visual and auditive enunciations and then integrates them. The approach that I have adopted consists in three separated steps:

step1 – we analyze spectator's beliefs about only for the visual component of a filmic segment;
step 2 – we analyze spectator's beliefs activated by the only auditive component (extradiegetic voice);
step 3 – we use the results of the analysis made in the steps 1 and 2, building one unique cognitive model.

To present the analysis and the results of the three steps, I consider the example formed by an extradiegetic voice and a visual component uttered in a synchronic way[20], namely in the same narration interval $[\mathsf{T1}, \mathsf{T2}]$. For the step 1 the model relative to the only visual component is shown in figure 4.5.2. In this model, for the time of enunciation TeEy and the time of event TaEy, is valid the axiom 4.4.3 that generates the belief $\mathsf{bel}(\mathsf{Spx}, \mathsf{sameT}(\mathsf{TaEy}, \mathsf{TeEy}))$ (the movie is at present).

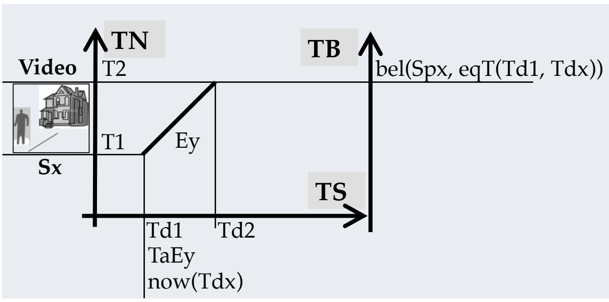


Figure 4.5.2: Diegetic event in which is shown a man going home

The step 2 regards the analysis of the spectator's beliefs in relation to the linguistic content – the extradiegetic voice (Vex) In an optic of cognitive analysis, my interpretation of the extradiegetic voice – as act of speaking – it is that the spectator though doesn't see a character to which associate this voice, builds anyhow temporal relations with other diegetic events reported in the

20 It is known that there is not always a synchronization between what is shown on the screen and the extradiegetic voice or sound. For example, when the voices of a dialogue are delayed by a few seconds and the screen shows a view of the previous sequence. For a discussion of these narrative figures, in particular on the notion of sonorous bridge, see [Chion2001].

images – in other words – the spectator considers the extradiegetic act of speaking in the same manner of a story event.

An extradiegetic voice doesn't come neither from the nearby, in the cinema, neither from a friend sitting in the lounge of the house, but from the screen. Also if is a voice talking from a fictional future, is an act of talking that is part of the representation (talking like event), this way it takes time of narration (the range $[T1, T2]$ in figure 4.5.4), just like the diegetic events on the screen take time of narration. An extradiegetic voice, it is in this way, an act of speech (an event) having many anomalous traits - first of all because it doesn't exist in that moment a character present in the diegesis who utters the words the spectator listens to[21].

For the reported anomalies, I have represented the extradiegetic voice as an event happening on the temporal axis as an extension of the story[22]. My proposal involves the accepting of an anomaly of terminological order as both the extradiegetic time and the diegetic one for the spectator are collocated on the same diegetic story axis[23]. My choice, has been forced, as it is from a temporal future instant that the spectator believes the extradiegetic voice speaks – this, above all for a deixis activated from the verbal tense used by the extradiegetic voice – that is almost always at past.

For the argumentation given, I have considered the extradiegetic voice as an event that happens in the diegesis, having as "when" component the event time, as "what" component (the action) the words uttered in the diegesis, and as "who" component (the participant in the event) the extradiegetic voice same (see representation 4.5.2).

---

21 The anomaly persists also if the extradiegetic voice pertains to a character Px in the story that is extradiegetic-homodiegetic. In this case also if it is present in the diegesis a voice speaking – the possessor Px of such voice is not physically shown. We can suppose that spectator associates the voice to an inner mental speaking, that no other character in the story can listen to.

22 I are aware to disagree with S. Chatman on this point as he affirms that: "the narrator has never been in the world of the work: the discourse time is not an extension of the time of the story made in a second moment" [Chatman2010] p. 163.

23 To accept this anomaly I have extended the definition of the story axis TS, representing on such axis, not only the time and the events of the story, but also everything that is shown uttered in the representation, that is, any auditive and visual component. This methodological approach can be applied in the analysis of other extradiegetic elements, such as music and noise, that can be extradiegetic too, and occupy temporal diegetic intervals and playing an important role for the multimedia composition of the filmic text.

In terms of Reichenbach's descriptors, an extradiegetic voice has a time of happening $TaEvx$ and a time of enunciation $TeEvx$. Since the event of telling Evx (the extradiegetic voice) is a diegetic event, it is valid the axiom 4.4.3 ("the movie is at present").

For this reason, the event time of the extradiegetic voice (considered as an action that occurs in time) coincides with the time of enunciation:

$$bel(Spx, sameT(TaEvx, TeEvx)) \tag{4.5.1}$$

Also being rare, we can't exclude the case that the extradiegetic voice has a time of reference. For example just think to an extradiegetic-homodiegetic voice of a character, who tells his life, but before his extradiegetic telling, he reports the starting time of his narration.

The representation of the beliefs relating to the event components of an extradiegetic voice, is the following:

$$\begin{array}{l} mev(Tx, bel(Spx, Evx)). \\ mev(Tx, bel(Spx, when(Evx, on(Td3, Td4)))). \\ mev(Tx, bel(Spx, who(Evx, vocex))). \\ mev(Tx, bel(Spx, what(Evx, say(vocex, when(Ex, on(Td1, Td2)))))). \\ mev(Tx, bel(Spx, what(Evx, say(vocex, what(Ex, Az))))). \\ mev(Tx, bel(Spx, what(Evx, say(vocex, who(Ex, P1, P2; ...; Pn))))). \end{array} \tag{4.5.2}$$

An event, described by the extradiegetic voice, produces a temporal deixis in the spectator due to the fact that (generally) the voice describes past events. The temporal deixis, in terms of spectator's beliefs, that are generated by the extradiegetic voice and the events described by this last one, are the following:

$$\begin{array}{l} bel(Spx, eq(TrEx, TaEx)) \\ bel(Spx, prec(TaEx, TaEvx)) \end{array} \tag{4.5.3}$$

The first of the two beliefs is inferred by the spectator when a linguistic form, of the type in examination, is enunciated. For example when a temporal adverbial (as "at seven o'clock") is present, and indicates the time in which the event has happened, determining so the following beliefs:

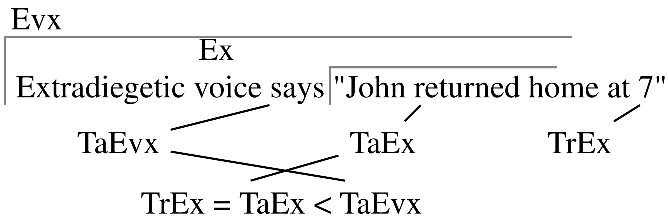


Figure 4.5.3: Temporal deixis between the enunciation (Evx) of the extradiegetic voice and the event (Ex) that describes it

$$\begin{aligned}&\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{taEx}(\mathsf{Ex}, \mathsf{TaEx}))),\\ &\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{trEx}(\mathsf{Ex}, \mathsf{TrEx})),\\ &\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{eqT}(\mathsf{TaEx}, \mathsf{TrEx}))).\end{aligned} \tag{4.5.4}$$

The beliefs reported in 4.5.3 are activated by the spectator in all those cases in which is enunciated a time of reference in the event Ex described by the extradiegetic voice, in which the time of enunciation coincides with the one of reference, when expressions such as ”at 14:30”, ”at 8 o’clock pm”, and so on, are used.

Generally an extradiegetic voice, that reports temporal descriptions, provides more information on what is happening, just regarding the diegetic instant that the spectator is observing[24].

Also if it is reported a certain continuative action in the sentence as in “John woke up at 8 as every morning” or also ”Margaret walked for hours under the rain, before protecting herself under a gate” and so on, in the uttered sentence there is always a temporal moment of reference that is a determinate complement. To note also that an extradiegetic voice doesn’t use expressions in which the time of reference is a temporal interval extended and undetermined as ”after the 4th of march”, or ”before the 7th of july”, but it uses times of reference well localized in time.

The extradiegetic voices and the captions often use, some forms of utterance in which the time of enunciation doesn’t coincide with the time of reference and where it exists between them a certain *temporal distance* – for example: “an hour before in the same Saturday afternoon” (extradiegetic voice in the *Killing* by S. Kubrick) or ”three days before the robbery” in *Before the*

24 The complement of time is a complement indicating the period of time in which the action takes place

Devil Knows You're Dead by S. Lumet [BeforeDevilKnows]. To represent this kind of sentences, as the ones reported, I have to consider the following relations between the time of reference and the one of the happening of Ex:

$$\begin{aligned}&mev(Tx, bel(Spx, taEx(Ex, TaEx)));\\&mev(Tx, bel(Spx, trEx(Ex, TrEx)));\\&mev(Tx, bel(Spx, eqT(TaEx, TrEx - Dt)))\end{aligned} \tag{4.5.5}$$

and

$$\begin{aligned}&mev(Tx, bel(Spx, taEx(Ex, TaEx)))\\&mev(Tx, bel(Spx, trEx(Ex, TrEx)))\\&mev(Tx, bel(Spx, eqT(TaEx, TrEx + Dt)))\end{aligned} \tag{4.5.6}$$

For sure the most important of the relations 4.5.3 is the second, which is inferred by the spectator by the following rule:

$$\begin{aligned}&mev(Tx, bel(Spx, prec(TaEx, TaEvx))) \quad \leftarrow\\&\ mev(Tx, bel(Spx, Evx)),\\&\ mev(Tx, bel(Spx, who(Evx, Vex))),\\&\ mev(Tx, bel(Spx, extradiegeticVoice(Vex))),\\&\ mev(Tx, bel(Spx, what(Evx, say(Vex, what(Ex, Az))))),\\&\ mev(Tx, bel(Spx, ta(Ex, TaEx))),\\&\ mev(Tx, bel(Spx, ta(Evx, TaEvx))),\\&\ mev(Tx, bel(Spx, propEv(Ex, pastTense(Az)))).\end{aligned} \tag{4.5.7}$$

The condition $mev(Tx, bel(Spx, propEv(Ex, pastTense(Az))))$ is essential in the rule 4.5.7 – the action time of the event, must be believed to happen into the past by the spectator. This condition is true in the most part of the utterances of an extradiegetic voice which always describes events happened.

Obviously, for stories with extradiegetic voices to comment or describe future events not yet happened[25] (as they would read in a crystal sphere) is valid an inference similar to 4.5.7, but with inverted sign ($prec(TaEvx, TaEx)$). The third of the beliefs 4.5.3, is an application of the axiom 4.4.3 ("the movie is at present").

25 To my knowledge, stories of this type, been yet produced.

In the **third step** we can overlap the event Ey, activated by an act of vision, with the event Ex described by the extradiegetic voice. The overlapping happens by virtue of the spectator's beliefs acquired from the visual component relative to the event Ey and to relative event described (commented or only evoked by the extradiegetic voice). By this comparison, it results: Spx believes that Ex and Ey are the same events.

$$mev(Tx, bel(Spx, sameE(Ey, Ex))) \tag{4.5.8}$$

There are various type of mental conditions that can lead the viewer to believe that Ex is the same element of Ey[26].

I wish to point out that the event shown from the images in the diegesis and the event evoked by extradiegetic voice, are not a repetition of an event – there aren't two events that are presented twice in the story (spectator's belief is $bel(Sx, rip(Ex, Ey)))$ – it is instead the same event having a different form in the filmic representation. The first is an event seen in the diegesis, and believed happen by the spectator, while the second hasn't been reported in the story, but has been only described by the extradiegetic voice.

So, with $bel(Spx, sameE(Ex, Ex)))$ I indicate the event Ex the voice is speaking about, is the same that has been presented on the scene (Ey).

In many cases the extradiegetic voice has a function to introduce new knowledge to complement some descriptions about events, or to provide redundancy to better put on evidence what the images are showing. So among the things described from the extradiegetic voice, there are parts of an event that have been visually enunciated in the diegesis, and there are others components of an event that instead repeat what the images propose. As reference for the discussion I take the following example:
Ex: an extradiegetic voice says "that morning of the 11 september John

26 In the next chapter I are going to give a general model, in which some conditions if verified, bring the spectator to believe that Ex and Ey are the same events.

bought the newspaper in the same newsagent"
Ey: the images show "a man who buys a newspaper".

	Name of man	Event time	Participant	Action	Space
Ex:	x	x	x	x	x
Ey:			x	x	x

As we can observe the name of the man and the date are only uttered in the text of the extradiegetic voice, while the action, the place (newsagent) and the participant (a man) are semantic information shared between the two events Ex and Ey.

These sharings are relative to specific attributes in the close context of the place where happens the event (the newsagent and the participant to the event – there is only a man), and they bring the spectator to infer that Ex and Ey are the same events.

In this meaning "same" means, that the events have a different representation but denote a same semantic entity.

The spectator reaches these conclusions above all because he believes that the action of the event Ex (the one described in the act of the extradiegetic word) and the one of the visual event Ey, are the same actions. There are other beliefs of the spectator that, in some cases, can reinforce the belief on the identity between Ex and Ey – for example, the viewer can believe that both the participants and the place in which the events happen, are the same. An identity model among the events is the one given in 5.2, in which there is a basic implication, regarding the fact that when there is identity between two events, they happen in the same diegetic interval:

$$\begin{array}{l} mev(Tx, bel(Spx, eq([T1, T2], [T3, T4]))) \leftarrow \\ \quad mev(Tx, bel(Spx, when(Ex, on([T1, T2])))), \\ \quad mev(Tx, bel(Spx, when(Ey, on([T3, T4])))), \\ \quad mev(Tx, bel(Spx, sameE(Ex, Ey))). \end{array}$$

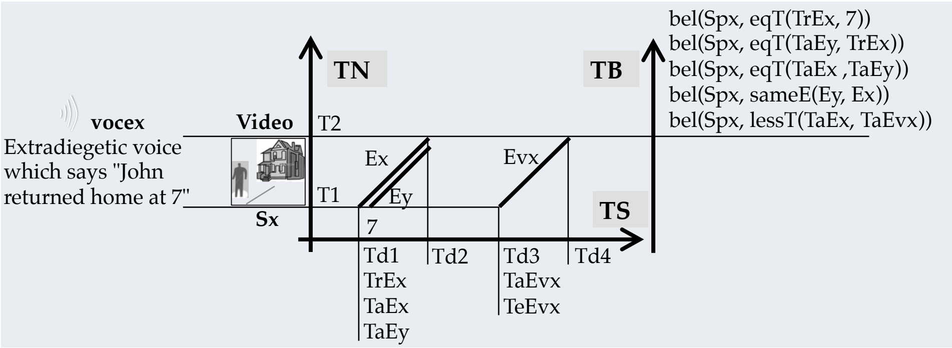


Figure 4.5.4: Spectator's beliefs on the temporal relations between the diegetic visual event and the event described by the extradiegetic voice (with $\mathsf{Ta{=}Tr}$)

or also in equivalent terms, Ex and Ey have the same time of happening:

$$\begin{aligned} & mev(Tx, bel(Spx, sameT(TaEx, TaEy))) \leftarrow \\ & \quad mev(Tx, bel(Spx, ta(Ex, TaEx))), \\ & \quad mev(Tx, bel(Spx, ta(Ey, TaEy))), \\ & \quad mev(Tx, bel(Spx, sameE(Ex, Ey))). \end{aligned} \tag{4.5.9}$$

In figure 4.5.4 I have integrated in an only diagram all the conclusions resulting from the inferences we have individuated in the different sentences analyzed (4.4.3, 4.5.1, 4.5.4, 4.5.7, 4.5.8 and 4.5.9). If the extradiegetic voice describes events in the form "Giovanni entered at home 10 minutes after seven (the considerations are valid also for all expressions such as "before seven") I have to consider instead of 4.5.4 the relation 4.5.6 or 4.5.5. I report the diagram of the relations between the visual diegetic event Ey (see figure 4.5.5) and the event Ex described from the extradiegetic voice, when the happening is successive to a certain temporal instant.

4.5.1 Captions or extradiegetic voices with only a cronological diegetic time

I propose a model represented in the diagram 4.4.2, which was built starting from the actions showing a chronological time – $what(Ex, show(D, Tdid))$ – where D is a caption or a extradiegetic voice. Such actions represent the

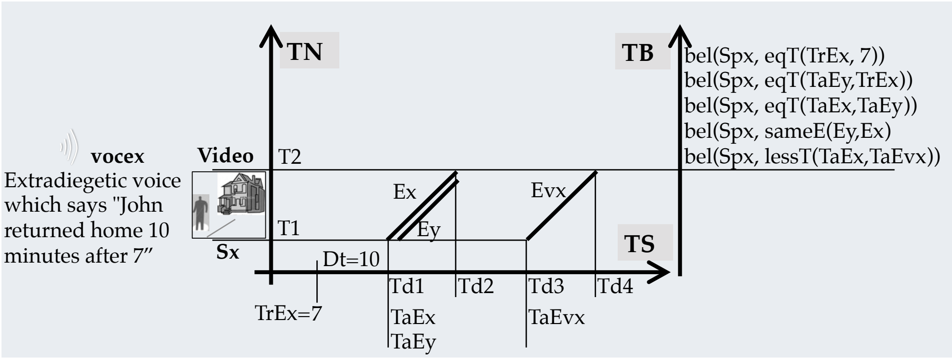


Figure 4.5.5: Spectator's belief on the temporal relations between the diegetic visual event and the event described by the extradiegetic voice (with Ta=Tr+Dt)

"what" of an event Ex that overlaps to an event $E2$, shown in the filmic images[27]. This overlap is represented by the following inference: Spx believes that reference time of $E2$ is $Tdid$, or the event time of $E2$ is $Tdid$ if Spx believes that: Ex happens; $E2$ happens; D is a participant in the Ex; D is a caption; in Ex the caption D shows a time $Tdid$; and Ex happens on the same interval of $E2$. I have represented the cognitive inference through two formal rules:

$$\begin{aligned} & mev(Tx, bel(Spx, tr(E2, Tdid))) \quad \leftarrow \\ & \; mev(Tx, bel(Spx, Ex)),\; mev(Tx, bel(Spx, E2)), \\ & \; mev(Tx, bel(Spx, who(Ex, D))), \\ & \; mev(Tx, bel(Spx, caption(D))), \\ & \; mev(Tx, bel(Spx, what(Ex, show(D, Tdid)))), \\ & \; mev(Tx, bel(Spx, eq(Ex, E2))). \end{aligned} \tag{4.5.10}$$

$$\begin{aligned} & mev(Tx, bel(Spx, ta(E2, Tdid))) \quad \leftarrow \\ & \; mev(Tx, bel(Spx, Ex)),\; mev(Tx, bel(Spx, E2)), \\ & \; mev(Tx, bel(Spx, who(Ex, D))), \\ & \; mev(Tx, bel(Spx, caption(D))), \\ & \; mev(Tx, bel(Spx, what(Ex, show(D, Tdid)))), \\ & \; mev(Tx, bel(Spx, eq(Ex, E2))). \end{aligned} \tag{4.5.11}$$

27 As it is known there exist phenomena where the voice (or the music) continues to send sound, also after the images of a subsequent event $E2$ are shown. These phenomena have been denominated by M. Chion "sounds bridge".

For an extradiegetic voice the enounce a temporal relationship we can be represented as an action of *saying* an event Ex (the "what" of Ex), reporting a chronological diegetic time. Spx believes that $TrE2$ is $Tdid$ of extradiegetic voice, or the event time $TaE2$ is $Tdid$ if the following conditions are true – Spx believes that: Ex happens; $E2$ happens; Vex is a participant in the Ex; $E2$ happens; Vex is a participant in the Ex; Vex is a extradiegetic voice; in Ex Vex enunciates a time $Tdid$; and Ex happens on the same interval of $E2$.

$$\begin{aligned}
&mev(Tx, bel(Spx, tr(E2, Tdid))) \leftarrow \\
&\ mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E2)), \\
&\ mev(Tx, bel(Spx, who(Ex, Vex))), \\
&\ mev(Tx, bel(Spx, extradiegeticVoice(Vex))) \\
&\ mev(Tx, bel(Spx, what(Ex, say(Vex, Tdid)))), \\
&\ mev(Tx, bel(Spx, eq(Ex, E2))).
\end{aligned} \tag{4.5.12}$$

$$\begin{aligned}
&mev(Tx, bel(Spx, ta(E2, Tdid))) \leftarrow \\
&\ mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E2)), \\
&\ mev(Tx, bel(Spx, who(Ex, Vex))), \\
&\ mev(Tx, bel(Spx, extradiegeticVoice(Vex))) \\
&\ mev(Tx, bel(Spx, what(Ex, say(Vex, Tdid)))), \\
&\ mev(Tx, bel(Spx, eq(Ex, E2))).
\end{aligned} \tag{4.5.13}$$

4.5.2 Captions or extradiegetic voices with only temporal relationship

Regarding the enunciations of temporal relationships, through an extradiegetic voice or caption, I have distinguished two types (see figure 4.4.1):

1. through adverbial temporal with a definite chronological interval ("after four months", "seven years before",...,)
2. through adverbial temporal with an indefinite chronological interval ("in the meantime", "some time later", "some spring ago",...,)

Temporal expressions above reported represent equivalent communicative acts as: the event $E2$ that now you are watching, happens before (after , in the same interval) of the event $E1$ you just finished watching. The act of showing a temporal relationship through a caption, can be represented as an action "show":

$$what(Ex, show(D, after(Dt))) \text{ or}$$
$$what(Ex, show(D, before(Dt))) \text{ or}$$
$$what(Ex, show(D, eq(E1, E2)))$$

where D is a caption of an event Ex, that we suppose it overlaps to the event $E2$ shown in the image. Obviously in the representation I have inserted the interpretation (the meaning) of the linguistic expressions of "what is shown" in a caption (linguistic forms as "after four months" and "seven years before",... – that I have represented with the formalism $after(Dt)$, $before(Dt)$), and $sameT(E1, E2)$).

For linguistic expressions of type $after(Dt)$ present in a caption, the following rule holds: Spx believes that the event time $TaE2 = TaE1 + Dt$ if Spx believes that: Ex happens; $E1$ happens; $E2$ happens; $E1$ is contiguous visibly to $E2$; D is a participant in the Ex; D is a caption; in Ex D shows a temporal after Dt adverbial of type "after Dt"; $TaE1$ is the event time of $E1$; and Ex happens on the same interval of $E2$.

$$\begin{aligned}
&mev(Tx, bel(Spx, ta(E2, TaE2))) \quad \leftarrow \\
&\quad mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E1)),\ mev(Tx, bel(Spx, E2)), \\
&\quad mev(Tx, bel(Spx, visContiguous(E1, E2))), \\
&\quad mev(Tx, bel(Spx, who(Ex, D))), \\
&\quad mev(Tx, bel(Spx, caption(D))), \\
&\quad mev(Tx, bel(Spx, what(Ex, show(D, after(Dt))))), \\
&\quad mev(Tx, bel(Spx, ta(E1, TaE1))), \\
&\quad mev(Tx, bel(Spx, eq(Ex, E2))),\ \ TaE2 = TaE1 + Dt.
\end{aligned} \tag{4.5.14}$$

The following rule holds: Spx believes that $eq(TaE2 = TaE1 - Dt)$ if Spx believes that: happens Ex, $E1$ happens; $E2$ happens; $E1$ is visually contiguous to $E2$; D is a participant in the Ex; D is a caption; in Ex D shows an temporal adverbial of type "before Dt"; $TaE1$ is the event time of $E1$; and Ex happens on the same interval of $E2$.

$$
\begin{aligned}
& mev(Tx, bel(Spx, ta(E2, TaE2))) \quad \leftarrow \\
& \quad mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E1)),\ mev(Tx, bel(Spx, E2)), \\
& \quad mev(Tx, bel(Spx, visContiguous(E1, E2))), \\
& \quad mev(Tx, bel(Spx, who(Ex, D))), \\
& \quad mev(Tx, bel(Spx, caption(D))), \\
& \quad mev(Tx, bel(Spx, what(Ex, show(D, before(Dt))))), \\
& \quad mev(Tx, bel(Spx, ta(E1, TaE1))), \\
& \quad mev(Tx, bel(Spx, eq(Ex, E2))),\ \ TaE2 = TaE1 - Dt.
\end{aligned}
\tag{4.5.15}
$$

For linguistic expressions of type $eq(E1, E2)$ present in a caption, the following rule holds: Spx believes that the event time $TaE2 = TaE1$ if Spx believes that: Ex happens; $E1$ happens; $E2$ happens; $E2$ is visually contiguous to $E1$; D is a participant in the Ex; D is a caption; D shows a temporal relationship whose meaning is that there is simultaneity between $E1$ and $E2$; $TaE1$ is the event time of $E1$; and Ex happens on the same interval of $E2$.

$$
\begin{aligned}
& mev(Tx, bel(Spx, ta(E2, Tdx))) \quad \leftarrow \\
& \quad mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E1)),\ mev(Tx, bel(Spx, E2)), \\
& \quad mev(Tx, bel(Spx, visContiguous(E1, E2))), \\
& \quad mev(Tx, bel(Spx, who(Ex, D))), \\
& \quad mev(Tx, bel(Spx, caption(D))), \\
& \quad mev(Tx, bel(Spx, what(Ex, show(D, atTime(Tdx))))), \\
& \quad mev(Tx, bel(Spx, ta(E1, Tdx))), \\
& \quad mev(Tx, bel(Spx, eq(Ex, E2))).
\end{aligned}
\tag{4.5.16}
$$

The act of showing a temporal relationship through an extradiegetic voice, is represented as an action "say":

$$
\begin{aligned}
& what(Ex, say(Vex, after(Dt)));\ what(Ex, sayVex, before(Dt)); \\
& what(Ex, say(Vex, eq(E1, E2)))
\end{aligned}
\tag{4.5.17}
$$

where Vex is an extradiegetic voice of an event Ex, that we suppose overlaps to the event $E2$ shown in the filmic images.

For linguistic expressions of type $after(Dt)$ present in an extradiegetic voice the following rule holds: Spx believes that the event time $TaE2 = TaE1 + Dt$ if Spx believes that: happens Ex; $E1$ happens; $E2$ happens; $E1$ is visually contiguous to $E2$; Vex is a participant in the Ex; Vex is a extradiegetic voice; Vex enunciates a temporal adverbial of type "after Dt"; $TaE1$ is the event time of $E1$; and Ex happens on the same interval of $E2$.

$$
\begin{aligned}
&mev(Tx, bel(Spx, ta(E2, TaE2))) \quad \leftarrow \\
&\quad mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E1)),\ mev(Tx, bel(Spx, E2)), \\
&\quad mev(Tx, bel(Spx, visContiguous(E1, E2))), \\
&\quad mev(Tx, bel(Spx, who(Ex, Vex))), \\
&\quad mev(Tx, bel(Spx, extradiegeticVoice(Vex))), \\
&\quad mev(Tx, bel(Spx, what(Ex, say(Vex, after(Dt))))), \\
&\quad mev(Tx, bel(Spx, ta(E1, TaE1))), \\
&\quad mev(Tx, bel(Spx, eq(Ex, E2))), \\
&\quad TaE2 = TaE1 + Dt, \\
&\quad mev(Tx, bel(Spx, eq(Ex, E2))).
\end{aligned}
\tag{4.5.18}
$$

For linguistic expressions of type $beforeDt$ present in an extradiegetic voice, the following rule holds: Spx believes that the event time $TaE2 = TaE1 - Dt$ if Spx believes that: Ex happens; $E1$ happens; $E2$ happens; $E1$ is visually contiguous to $E2$; Vex is a participant in the Ex; Vex is a extradiegetic voice;

in Ex Vex enunciates an temporal adverbial of type "before Dt"; $TaE1$ is the event time of $E1$; and Ex happens on the same interval of $E2$.

$$
\begin{aligned}
& mev(Tx, bel(Spx, ta(E2, TaE2))) \quad \leftarrow \\
& \quad mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E1)),\ mev(Tx, bel(Spx, E2)), \\
& \quad mev(Tx, bel(Spx, visContiguous(E1, E2))), \\
& \quad mev(Tx, bel(Spx, who(Ex, Vex))), \\
& \quad mev(Tx, bel(Spx, extradiegeticVoice(Vex))), \\
& \quad mev(Tx, bel(Spx, what(Ex, say(Vex, before(Dt))))), \\
& \quad mev(Tx, bel(Spx, ta(E1, TaE1))), \\
& \quad mev(Tx, bel(Spx, eq(Ex, E2))), \\
& \quad TaE2 = TaE1 - Dt.
\end{aligned}
\tag{4.5.19}
$$

For linguistic expressions of type $eq(E1, E2)$ present in an extradiegetic voice, the following rule holds: Spx believes that the event time Spx believes that the event time $TaE2 = TaE1$ if Spx believes that: Ex happens; $E1$ happens;$E2$ happens; $E1$ is visually contiguous to $E2$; Vex is a participant in the Ex; Vex is a extradiegetic voice; Vex enunciates a temporal relation whose meaning is that there is simultaneity between $E1$ and $E2$; $TaE1$ is the event time of $E1$; and Ex happens on the same interval of $E2$.

$$
\begin{aligned}
& mev(Tx, bel(Spx, ta(E2, TaE1))) \quad \leftarrow \\
& \quad mev(Tx, bel(Spx, Ex)),\ mev(Tx, bel(Spx, E1)),\ mev(Tx, bel(Spx, E2)), \\
& \quad mev(Tx, bel(Spx, visContiguous(E1, E2))), \\
& \quad mev(Tx, bel(Spx, who(Ex, Vex))), \\
& \quad mev(Tx, bel(Spx, extradiegeticVoice(Vex))), \\
& \quad mev(Tx, bel(Spx, what(Ex, say(Vex, eq(E1, E2))))), \\
& \quad mev(Tx, bel(Spx, ta(E1, TaE1))), \\
& \quad mev(Tx, bel(Spx, eq(Ex, E2))).
\end{aligned}
\tag{4.5.20}
$$

4.5.3 Temporal anchoring generated through an extradiegetic voice or by a caption

Many stories present a narrative form wholly constituted by flashback or flash-forward, staging as reference time at the beginning of a sequence. This stories often maintain a same form of enunciation in all the narration. As I have seen till now in this section, captions and extradiegetic voices create beliefs in the spectator according to the event time (represented through an explicit chronological form) and to the reference time, recorded in the form:

$$\mathsf{bel(Spx, ta(Ex, TaEx))}$$
$$\mathit{with}\ \mathsf{TaEx = TrEx - Dt; TaEx = TrEx + Dt\ or\ TaEx = TrEx}$$

From this beliefs – regardless how they was created, if through an extradiegetic voice, or a caption and others elements of staging – the spectator builds his inferences to define eventual flashbacks or flashforwards of the story. In these kinds of movies, as the event time is expressed in explicit form, the spectator has just to compare the values associated to the event time of TaEx with the analogue TaEy of another event, to establish if TaEx precedes, follows or has the same value of TaEy.

In the stories the events Ex and Ey of which the spectator has to activate a comparison, aren't visually contiguous in the narration, but they belong to two different narrative structures that I have defined as macro events[28] – that are visually contiguous.

What we are discussing is a narrative form that it is frequently adopted in many movie's stories – examples of movies having a such structure are: *The killing* (through an extradiegetic voice) *Before the Devil Knows You're Dead* and *Duplicity* (through captions).

In the chapter 7.3 I argued that, for some filmic sequences (macroevents), which are announced through a caption or by an extradiegetic voice, the viewer associates a time with the entire macro event (bel(Spx,ta(Mex,TaMe)).

This time is the starting instant of the first event of macro event, as it is just this instant that the spectator *has in his mind* when executes a temporal anchoring with other events or groups of events.

28 I will give these conditions later in this book, after the notion of macro event in chapter 7 will be introduced.

Figure 4.5.6: Reference time through extradiegetic voice *The Killing*

I will retake the argument in paragraph 7.5 – actually I anticipate an inference of the model: Spx believes that $E2$ is a flashforward of $E1$ if Spx believes that: $E1$ happens; $E2$ happens; $Me1$ and $Me2$ are visually contiguous; $E1$ is the first event of $Me1$; $E2$ is the first event of $Me2$; $E1$ and $E2$ belong to the same story; $TaE1$ is the event time of $E1$; $TaE2$ is the event time of $E2$; and $E1$ precedes $E2$.

$$\begin{aligned}
&\mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{flashforward}(E2, E1))) \quad \leftarrow \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, E1)),\ \mathsf{mev}(Tx, \mathsf{bel}(Spx, E2)), \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{visContiguous}(Me1, Me2))), \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{first}(E1, Me1))), \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{first}(E2, Me2))), \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{sameStory}(Str, E1, E2))),\ \mathsf{story}(Str), \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{ta}(E1, TaE1))),\ \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{ta}(E2, TaE2))), \\
&\quad \mathsf{mev}(Tx, \mathsf{bel}(Spx, \mathsf{less}(TaE1, TaE2))).
\end{aligned} \tag{4.5.21}$$

Obviously there is a similar inference, to the one just presented, which regards flashback between two events, the latter will be presented later in this book.

Figure 4.5.7: Reference time through caption in *Before the Devil Knows You're Dead*

5 TEMPORAL DEIXIS FOR EVOCATION AND OTHER FITTINGS

In this chapter I analyze the spectator's cognitive activities in which he performs a temporal anchoring between two diegetic events not (necessarily) visually contiguous in the telling, so as it happens regarding flashbacks and flashforwards. The kinds of anchoring I are going to examine are characterized by a cognitive relation, composed of two events I call **evoked event** (Ey) and **evoking event** (Ex):

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{deixis}(\mathsf{Ex}, \mathsf{Ey}))$$

The evoking event Ex is directly (or indirectly through an act of telling or thinking) present in the current diegesis, while the one evoked is not. Notwithstanding the particular link (evocation) existing between two events, the spectator is able to establish a temporal relation between Ex and Ey, where Ex can happen in the story before, after or on the same temporal interval of Ey. I have denominated these spectator's cooperative activities – *temporal deixis through evocation*.

As I anticipated in the previous chapter, a temporal deixis for evocation doesn't interrupt the current course of events. This last goes on, in a strict linear temporal order for every pair of events – if in the narration, an event Ea is shown first of an event Eb, then in the story Ea happens first of Eb.

Temporal deixis are narration figures used to link filmic sequences that have undergone a temporal *fracture* in the story, previously generated by an ellipsis, a flashback or a flashforward.

Temporal links don't happen only for the nature of the events, but also for the presence of eventual cognitive states in the spectator generated by a kind of cognitive hooks[1] and that are used in a determined point of the

1 Cognitive hooks have a corresponding definition in the literary text in the concept called by G. Genette ”baits” [Genette1986] p. 123)

narration and explicitly quoted or subsequently evoked in the story. There are cognitive hooks that are created when a character makes a promise to perform an action (a travel, a menace of killing someone, and so on), when a character reports that an event happened, or that will happen in the story. These hooks are afterwards used in the story when the events or the promised actions are confirmed – if in a part of the narration a character promises he will make a journey in a determined place, he is shown in that place, then the spectator believes that the journey (also if it isn't shown in the telling) has been made by that character and the diegetic time in which the promise has been made will be believed antecedent to the one of the journey (this is true, also if the presentation order of the sequences in the telling is inverted).

For the representation of the temporal deixis rules, I have chosen two main beliefs that in particular situations permit the connection of two events of a story: the beliefs for causation of events and the belief for the repetition of events:

```
bel(Spx, cause(Ex, Ey))   % Spx believes that Ex causes Ey
bel(Spx, rep(Ey, Ex))     % Spx believes that Ey is a repetition of Ex
```

The first belief is a spectator's primitive one, while for the second I will give a model and some inferential rules to permit its acquisition.

5.1 REPETITION OF EVENTS – A PRELIMINARY DISCUSSION

As beginning discussion for my proposal of cognitive model for the fitting to the story fragmentation, I report a preliminary discussion on the concept of events repetition, once again starting by G. Genette's thought[2]:

> The "repetition" is in fact a mental construction, which eliminates from each occurrence everything belonging to it that is peculiar to itself, in order to preserve only what it shares with all the others of the same class, which is an abstraction: "the sun," "the morning," "to rise." This is well known, and I recall it only to specify once and for all that what

2 In [Genette1980], pp. 113-114.

> I will name here "identical events" or "recurrence of the same event" is a series of several similar events considered only in terms of their resemblance.
>
> Symmetrically, a narrative statement is not only produced, it can be produced again, can be repeated one or more times in the same text: nothing prevents me from saying or writing, ”Pierre came yesterday evening, Pierre came yesterday evening, Pierre came yesterday evening.” Here again, the identity and therefore the repetition are facts of abstraction; materially (phonetically or graphically) or even ideally (linguistically) none of the occurrences is completely identical to the others, solely by virtue of their co-presence and their succession, which diversify these three statements into a first, a next, and a last. Here again one can refer to the famous pages of the *Cours de linguistique générale* on the ”problem of identities.” That is a further abstraction to take into consideration, and we will do so.

It is evident, according to G. Genette, that identical events don't exist and when he affirms that a determined event is repeated, many similar things are in fact repeated – in this meaning the repetition can never be reached, because there is always an attribute, or a property of the event, that it is not repeated. In this direction, the sublimation of G. Genette is to assert that not even the repetition of “yesterday evening Peter has come” n times in a same written text, constitutes a repetition, because “no one circumstances is materially (phonically and graphically) completely identical to the others”. Applied to the filmic text, this position is equivalent to affirm that the filmic events never repeat themselves, because although in some circumstances an event $\mathsf{E}x$ presents itself with the same representation of another event $\mathsf{E}y$, already told in the story, $\mathsf{E}x$ is different from $\mathsf{E}y$ only because shown in a different interval in the narration time.

In the context we are analyzing, even if sharing G. Genette's argumentations, we are not interested in *how things are* from a point of view of material circumstances of the events presented in the text (literary or filmic it doesn't matter), but to what *happens* in the mind of a spectator when he believes that an event is shown again in a story. We are going to listen to the spectator, who is ready to swear that an event has happened again – he affirms this without keeping into account of the different narration times in which the story events are shown.

Definitively, my survey definitively is the one of searching and understanding what are the mental conditions so that a spectator accepts – with conviction, lightly, for author's tricks or for other motivations (it doesn't matter which) – for believing that a repetition of an event occurs. Before proposing an event repetition model, I will discuss on the difference existing between the repeating of an action and "the repeating of anevent". These concepts should be strictly characterized and divided – to this aim I have represented in cognitive terms (spectator's belief) the concept of frequency introduced by G. Genette.

FREQUENCY. The events that repeat itself in a story are placed in the analytic-theoretical topic, denominated "frequency", defined as the relation of the times that a determined event is reported in the telling and the times it has happened (or that we presume has happened) in the story. In literature[3] four relations of frequency have been distinguished. According to them, a narrative, of every kind, can tell:

1. Only once when happened only once (1R/1S) – singulative narrative;
2. N times when happened n times (nR/nS) – anaphoric narrative;
3. N times when happened only once (nR/1S) – repetitive narrative;
4. Once when happened n times (1R/nS) – iterative narrative.

G. Genette's elegant scheme above given[4] has (maybe for conciseness reasons of the same author) an imprecision: it is not specified in the various cases the term "happened" who is referred to – if to the action or to the event. To this aim, we consider two hypothetical filmic sequences:

a. the same man waking up every morning at the same hour, eats the same breakfast at the same kitchen table, with a little variation – every day he puts a different quantity (an increasing quantity) of sugar in his coffee

3 The distinction is once more by G.Genette [Genette1986].
4 Examples for every frequency categories are respectively:

a. yesterday I went to bed early (1R/1S);
b. on Monday I went to bed early, on tuesday I went to bed early, and so on (nR/nS);
c. yesterday I went to bed early, yesterday I went to bed early, and so on (nR/1S);
d. for a long time I 've gone to bed early (1R/nS) (from wikipedia - exact reference lost)

b. a goal in a football match is projected more times from different angulations – once also with a rallenty (slow motion)

The sequence a. is an instance of the scheme 2) – while in the sequence b. of the scheme 3) (the same event is repeated n times). In the representation of an event, given in the chapter 2, I have distinguished the *what* (that is the action of the event) from the event itself. The latter differentiates from the action as it has an essential attribute the *when*, that gives indications on the interval time in which the action takes place. The distinction between event and action, allows us to do some distinctions in the scheme above reported. In the first case 2) it is not the event that is repeated ("has happened") n times, but the action (only the attribute *what* of the event), as the action of having breakfast every morning happens on a different diegetic time – there is a time passing every day. In an explicit way to convince that the diegetic time is different, we can think to ideally introduce in the sequences a calendar that every day update the date.

For the argumentation given above, I suggest a terminological adjustment in G. Genette's scheme given above – we can rewrite the 2. and 3. definition, in the following way:

2'. it is shown nR times (in the telling) when **an action** has happened mS times (in the story):
3'. it is shown nR times (in the telling) when **an event** has happened only one (in the story) (1S).

IL CASO ANAFORICO (nR/nS). The structure of the anaphoric case (nR/nS) is constituted by a series of sequences $Sq1, Sq2, \ldots, SqN$ of the telling:

$$\begin{array}{l} Sq1{:=}E1a, E1b, \ldots, E1m \\ Sq2{:=}E2a, E2b, \ldots, E2m \\ \ldots \\ SqN{:=}Ena, Enb, \ldots, Enm \end{array}$$

In the sequences there are homologous events, for example $E1a, E2a, \ldots, Ena$ in which the spectator believes that the same action happens – also if in different diegetic time. Formally, regarding the N times an event happens in the narration, the spectator acquires the following beliefs:

$$\begin{array}{ll}
\mathsf{bel}(Sx, \mathsf{when}(E1a, \mathsf{on}([Td1a, Td2a]))), & \mathsf{bel}(Sx, \mathsf{what}(E1a, A1a)), \\
\mathsf{bel}(Sx, \mathsf{when}(E2a, \mathsf{on}([Td3a, Td4a]))), & \mathsf{bel}(Sx, \mathsf{what}(E2a, A2a)), \\
\ldots \mathsf{bel}(Sx, \mathsf{when}(Ena, \mathsf{on}([Tdi, Tdj]))), & \mathsf{bel}(Sx, \mathsf{what}(Ena, Ana)), \\
 & \\
\mathsf{bel}(Sx, \mathsf{when}(E1b, \mathsf{on}([Td1b, Td2b]))), & \mathsf{bel}(Sx, \mathsf{what}(E1b, A1b)). \\
\ldots &
\end{array} \tag{5.1.1}$$

and the following beliefs on the repetition of the actions:

$$\begin{array}{ll}
\mathsf{bel}(Spx, \mathsf{rep}(A1a, A2a)), & \mathsf{bel}(Spx, \mathsf{rep}(A2a, A3a)), \\
\ldots \mathsf{bel}(Spx, \mathsf{rep}(Ama, Ana)), & \\
\mathsf{bel}(Spx, \mathsf{rep}(A1b, A2b)), & \mathsf{bel}(Spx, \mathsf{rep}(A2b, A3b)), \\
\ldots \mathsf{bel}(Spx, \mathsf{rep}(Amb, Anb)), & \\
\mathsf{bel}(Spx, \mathsf{rep}(A1z, A2z)), & \mathsf{bel}(Spx, \mathsf{rep}(A2z, A3z)), \\
\ldots \mathsf{bel}(Spx, \mathsf{rep}(Amz, Anz)) &
\end{array} \tag{5.1.2}$$

I have to add that in some anaphoric narrative, there are cases in which not all the actions of the sequences $Sq1, \ldots, SqN$ are repeated, or also cases in which the action varies in small details. It is obvious that this is performed with the clear objective of representing an improvement or worsening of a situation (for instance to represent a character increasingly tired of performing a same action, or ever more happy to repeat it).

THE REPETITIVE CASE$(nR/1S)$. In this case, the event in its entire component that repeats itself. Since beside the action, for example the goal scoring in the example b) in the previous paragraph, the space (the football ground) and one or more characters (players) that are always the same, there is a same diegetic interval on which the event happens. In this case, too, to be convinced (in the example of the match taking into account) it is sufficient to introduce a clock on the jumbo screen of the stadium, in which it is reported the diegetic time of the ending and of the beginning of the actions. In nR times that an event in the telling is shown, the spectator acquires the same beliefs reported in 5.1.1 and 5.1.2, but there are other conditions requiring that events happen on the same time intervals:

```
bel(Spx, eq([Td1, Td2], [Td3, Td4])), . . . ,
bel(Spx, eq([Td(i-1), Td(j-1)], [Tdi, Tdj]))
```

THE ITERATIVE CASE (1R/nS). In this case, speaking about repetition of events is not correct, but of a repetition of an action (typical) happening in different intervals in different diegetic time. To be noted that through the use of linguistic expressions you can represent repetition of typical actions in an only utterance – for example, with a extradiegetic voice uttering ”Mario went every morning to school”, or with a character telling ”He usually has breakfast at 8 every morning”.

An iterative case in the filmic language can't be performed in an only visual act – the representation required at least the repetition of an action. It is a technique acting on the spectator as a kind of principle of mathematic induction, in which he believes that if two actions happen in two or more consecutive days these happens a number of times (with m > 2). So, instead that once 1R in the telling and nS times in the story (1R/nS), we are in the case mR/nS with $mR < nS$. In other words there are few (m > 2) repetitions (mR) of an event in a telling, this allows the spectator to infer that an action has happened nS times in the story. This case so has some tracts in common with the anaphoric case, but the aim of these sequences is generally that of presenting the repetitions of actions with the purpose of putting on stage a summary, and they haven't the aim to represent situations evolving in the diegetic time, as in the anaphoric case.

5.2 A MODEL FOR THE SAMENESS AND REPETITION BETWEEN TWO EVENTS

Even if it could already emerging from the discussion developed until this point, the repetition of two events is itself a cognitive affair (a “mental construction” according to G. Genette) – and it couldn't be otherwise. It results that every time there is a mental operation to establish that an event E2 is a repetition of another event E1, the spectator performs some comparisons (an inference) between two or more attributes of the events $E1$, $E2$ – he checks if the two events have the same participants, if they happen in the same space, if in them there are the same actions and so on.

I anticipate that:

1. the spectator for believing that $E1$ and $E2$ are the same events, has not to perform all the comparison for every pairs of attributes of $E2$ and $E1$ – this furthermore is not always possible – as not always are reported in the diegesis all the components of an event;
2. the sameness of events $E1$ and $E2$ does not require that the events are shown in the diegesis, but are only described.

The sameness among events is a condition that can be used to relate events that are not shown in the diegesis, and that are only described, for example by a specific character Px or reported in a media (photo, Tv etc.). In all these cases, the events have not shown in the diegesis. In some stories happens that two characters describe both two events (separately), and the spectator believes that the two events are the same.

The identity of the action ($bel(Spx, sameA(A1, A2))$) plays a fundamental role for the spectator's beliefs on identity among events, as in all the inference types that lead to the spectator's belief that $E1$ and $E2$ are the same events ($bel(Spx, sameE(E1, E2))$).

UNIQUENESS OF THE ACTION. A criterion for the sameness among events, can be defined through the action. If two actions $A1$ and $A2$ are present in the diegesis, the spectator for believing they belong to a same event, and not to two different events, must believe that $A1$ and $A2$ have features of uniqueness, that is the action can only happen once in the story (unr).

For the sameness of two events $E1$ and $E2$, the spectator should believe that their respective actions $A1$ and $A2$ are not an instance of a same kind of actions – as leaving home every morning or having a tea at five every day – but that $A1$ and $A2$ are two different representations of a same action, happening once in the story. They have the feature of uniqueness, actions as: dying, marrying (believing also that the character has been married only one), taking a degree (believing also that he has taken his degree only once), winning or losing the most important competition in life and so on.

I report a rule for the sameness of two events $E1$ and $E2$: the spectator Spx believes that $E1$ and $E2$ are the same events if Spx believes that: $A1$ is an action of $E1$; $A2$ is an action of $E2$; $A1$ and $A2$ are the same action; $A2$ is an unrepeatable action in the story.

$$\begin{aligned}
&mev(Tx, Spx, sameE(E1, E2)) \leftarrow\\
&\ mev(Tx, bel(Spx, what(E1, A1))),\\
&\ mev(Tx, bel(Spx, what(E2, A2))),\\
&\ mev(Tx, bel(Spx, sameA(A2, A1))),\\
&\ mev(Tx, bel(Spx, unr(A2))).
\end{aligned} \tag{5.2.1}$$

In order that two events $E1$ and $E2$ are the same in the diegesis, is not necessary that $E1$ and $E2$ have the same actions, the same diegetic space, and the same characters. In the movie *Mistery Train*[5], a radio message, announcing a song by Elvis Presley, recurs in different sequences of events having characters and places very different among them. The action is specific (the one of the announcement of the song by Elvis) and it is common to all the sequences in which some characters change – the uniqueness of the action is sufficient to grant that it is the same event. In *Before the Rain* in a sequence a girl is killed in Macedonia, in another sequence (in a second time in the narration) the event is presented in London in in a newspaper's photo showing the killed girl – obviously as news of an event happened. In this case, the action, the death of the girl, is unrepeatable in the story – the condition is sufficient to believe that it is the same event.

EVENTS SAMENESS FOR SPECIFICITY. A condition for the sameness between two events can be defined also by the sameness, besides the

5 [MysteryTrain]

action, of all the components of the events (situation I have called specificity of the conditions).

$$
\begin{array}{ll}
 & \text{\% Spx believes that } \mathsf{E1} \\
 & \text{\% } \mathsf{E2} \text{ are the same} \\
mev(\mathsf{Tx}, bel(\mathsf{Spx}, sameE(\mathsf{E2}, \mathsf{E1}))) \leftarrow & \text{\% events if:} \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, what(\mathsf{E1}, A1))), & \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, what(\mathsf{E2}, A2))), & \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, sameA(A1, A2))), & \text{\% } A1 \text{ and } A2 \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, where(\mathsf{E1}, Wr1))), & \text{\% are the same actions;} \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, where(\mathsf{E2}, Wr2))), & \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, sameS(Wr2, Wr1))), & \text{\% } \mathsf{E1} \text{ and } \mathsf{E2} \text{ happen} \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, who(\mathsf{E1}, ListWho1))), & \text{\% in the same space;} \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, who(\mathsf{E2}, ListWho2))), & \\
\quad mev(\mathsf{Tx}, bel(\mathsf{Spx}, sameP(ListWho1, ListWho2))) & \text{\% in } \mathsf{E1} \text{ and } \mathsf{E2} \\
 & \text{\% take part the} \\
 & \text{\% same characters.}
\end{array}
\tag{5.2.2}
$$

If the spectator Spx believes that two events $\mathsf{E1}$ and $\mathsf{E2}$ have the same actions, the same characters and happen in the same space, then Spx believes that $\mathsf{E2}$ and $\mathsf{E1}$ are the same events. I desire underline that the sameness condition doesn't ask that there is an sameness of all event components (actions, characters and places) in the same modalities. The spectator believes that two events $\mathsf{E1}$ and $\mathsf{E2}$ are the same events also if the components of $\mathsf{E1}$ and $\mathsf{E2}$ are shown from different points of view – a goal in a football match can be presented in different events, in many spatial points of view, in natural times of execution or in slow down modalities – what is important in the sameness inference are spectator's beliefs conditions, the latter are independent by the modalities in which are presented actions, characters and places. The models given and the spectator's cognitive conditions associated to the identity between two, could appear *approximate and superficial*. Certainly the approximations exist, but I believe they don't regard the representation but what we are representing, that is the spectator. This last is a little rigorous observer, careless and sometimes ingenuous, as consequence often he does check the exact cognitive conditions for the sameness among events. The model I give tries to be faithful to the cognitive activities of a person who watches the movie – he takes into account only few factors, few attributes, and then decides – he does it with a rapid receptive filter, accepting and believing almost everything he sees. In contraposition to this lack of strictness in the receptive phase, if the specta-

(a) Start of robbery sequence in the bar

(b)

(c)

(d) Beginning of repetition of the robbery sequence in the bar

(e)

(f)

Figure 5.2.1: Repetition of events in *Pulp Fiction*

tor detects an error in its assumptions of beliefs (this is valid in every case, not only on the sameness of events), often relies on his efficacious revision methods, by which he is able to remove his erroneous suppositions.

Generally, regarding the beliefs on sameness among events, what happens is that, for the skills and abilities of the directing, the spectator almost never makes mistakes.

REPETITION OF EVENTS. Until here in this paragraph, I have supposed that the condition of sameness among events ($bel(Spx, sameE(E1, E2))$) does not require that the events are shown in the diegesis. I introduce the repetition of events ($mev(Tx, bel(Spx, rep(E2, E1)))$) as notion where a condition of presentation in the diegesis of the events is necessary[6]. The spectator's belief about a repetition of two events E2, E1 is the following[7]:

```
                                                   % the spectator Spx believes that
mev(Tx, Spx, rep(E2, E1)) ←                        % E2 is an repetition of E1 if
  visActE([T1, T2], Spx, Seg1, [Td1, Td2], E1),
  visActE([T3, T4], Spx, Seg2, [Td3, Td4], E2),
  T4 < Tx,
  mev(Tx, bel(Spx, sameE(E2, E1))),                % E1 and E2 are the same events
  time(T1), time(T2), time(T3), time(T4),
  diegeticTime(Td1), diegeticTime(Td2),
  diegeticTime(Td3), diegeticTime(Td4),
  filmicSegment(Seg1),
  filmicSegment(Seg2).
```

6 At this point I consider useful reassume the different meanings, of formalism so far presented, regarding the belief relationships of story's events "rep", "sameE", "eq", and ("prec"):

Formalism	**Meaning**
$bel(Spx, rep(E1, E2))$	% Spx believes that E2 is an repetition of E1
$bel(Spx, sameE(E1, E2))$	% Spx believes that E2 is identical to E1
$bel(Spx, eq(E1, E2))$	% Spx believes that E1 happens in the same interval of E2
$bel(Spx, prec(E1, E2))$	% Spx believes that E1 precedes E2

(5.2.3)

7 We remember that in the conditions

$$visActE([T1, T2], Spx, Seg1, [Td1, Td2], E1)$$
$$visActE([T3, T4], Spx, Seg2, [Td3, Td4], E2)$$

E1 and E2 denote "events shown" in the diegesis.

$$(5.2.4)$$

The difference existing between a repetition of two events $E1$ and $E2$ and the sameness between them (that is the difference between $bel(Spx, rep(E1, E2)))$ and $bel(Spx, sameE(E2, E1)))$, consists that in the first case the events have been presented through images in the story (they have been *seen happening* by the spectator), while in the second case $E1$ and $E2$ are identical – $E1$ and $E2$ not necessarily have been shown. For the condition $rep(E2, E1)$ the events have been presented to the spectator in a direct way – without the character's mediation – while for $sameE(E2, E1)$ is sufficient for example that there is a communicative act among characters. The most frequent communicative act is one of a character describing an event Ex happened to another character, in relation to which the spectator believes that it has not yet been shown in the diegesis (or also that has been described by another character), but Ex has happened in the story.

I would like to point out that the repetition of two events $E1$ and $E2$ implies the sameness between the $E1$ and $E2$:

$$\begin{aligned} &mev(Tx, bel(Spx, sameE(E2, E1))) \leftarrow \\ &mev(Tx, bel(Spx, rep(E2, E1))). \end{aligned} \tag{5.2.5}$$

Viceversa is not valid, that is, if the spectator believes that two events are the same event, this doesn't imply that he believes that they have happened in the story – if an event $E1$ is described by a character Px and another event $E2$ occurs in the story of Px with the same characteristics of action, participants and place, $E2$ is not a repetition of $E1$ – $E1$ is described while $E2$ has happened in the story.

A well-known example of an event, repeated in the narration, occurs in *Pulp Fiction*[8] (figure 5.2.1) in the filmic sequence of the gun pointed at clients in a bar by two young robbers. The event is presented the first time in the beginning of the telling, before the credits (a, b, c in figure 5.2.1) and is repeated (by another point of view) in the end of the narration (d, e , f in the same figure). The specificity of the characters, of the place (the bar) and of the action (the robbery), leaves no doubt in the spectator – he believes that is a repetition of an event in the telling.

8 [PulpFiction]

(a) Tr = 53:02 Beginning of the brawl sequence in the bar **(b)** Tr = 53:08 **(c)** Tr = 54:07 **(d)** Tr = 54:14 End of brawl sequence in the bar

(e) Tr = 1:01:52 Beginning of the repetition of brawl sequence in the bar **(f)** Tr = 1:01:56. **(g)** Tr = 1:02:07 **(h)** Tr = 1:02:11 End of the repetition of brawl sequence in the bar

Figure 5.2.2: Repetition of events in *The Killing*

Another example, that according to me has been a forerunner of the use of repetition of events, it is in *The killing*[9] (figure 5.2.2). In a first sequence of images, a former boxer, in the inner room of a hippodrome, provokes the barman (figure 5.2.2a), fights with the guards (figure 5.2.2c) and some agents run out from a door in the end of the hall (figure 5.2.2d). Further on the narration, the boxer provocation is repeated (figure 5.2.2e) – two agents are inside the office, the same agents who run out from the door in which there is John (the protagonist) standing with a bag in his hands (figure 5.2.2h). The images propose, in this way, events that are repeated in two different sequences – then the spectator believes that a repetition of events has happened. We are in the condition of frequency N times in the telling – once in the story.

9 [TheKilling]

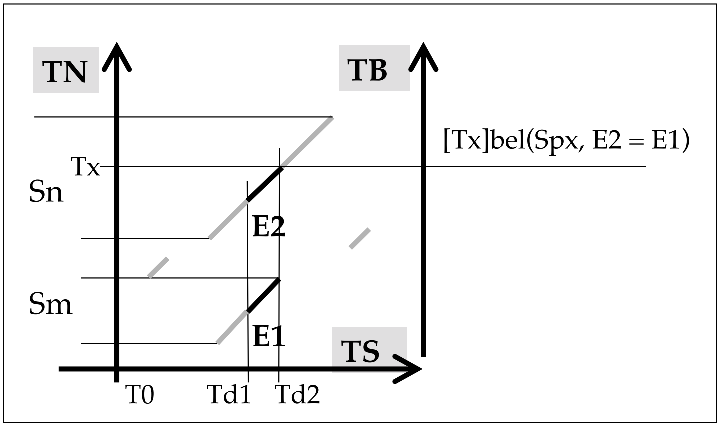


Figure 5.3.1: Anchoring through the repetition of events – TN-TS-TM diagram

5.3 TEMPORAL ANCHORING FOR THE REPETITION OF EVENTS

It exists a rule for temporal anchoring, built on the condition of repetition of an event. Such rule is of extreme importance for stories presenting some particular breaking of the temporal axis.

In all the movies that have been reported as examples in the previous paragraph – *Pulp Fiction*, *The Killing*, *Mistery Train* and *Before the Rain* – is present a repetition of events. This last belief is a spectator's key condition to execute a particular anchoring I have denominated temporal anchoring for repetition of events – the case regards the category "repetitive narrative" ($nR/1S$), in which I have emphasized that the repetition concerns the event and not the action.

The rule of anchoring for repetition of events establishes that if the spectator believes that an event $E2$ is a repetition of another event $E1$, $E2$ happens in the same temporal interval of the event $E1$ (see figure 5.3.1). That is generally true in an independent manner by the modality with which the spectator has acquired the beliefs on the happening of E1 and $E2$[10]. We remember that if in the current sequence the event $E2$ is shown and the event $E1$ is evoked – the rule I formulate constitutes a deixis for evocation. The rule of anchoring

10 For example the beliefs on events $E1$ and $E2$ can be acquired after have shown in the diegesis two identical events but filmed from different positions and angles of shooting.

through repetition of events, is the following[11]: Spx believes that $E1$ and $E2$ happen on the same diegetical interval if Spx believes that: $E1$ happens; $E2$ happens; and $E2$ is a repetition of $E1$. Formally:

$$\begin{aligned}&mev(Tx, Spx, eq(E1, E2)) \leftarrow\\ &\ mev(Tx, bel(Spx, E1)),\\ &\ mev(Tx, bel(Spx, E2)),\\ &\ mev(Tx, bel(Spx, rep(E2, E1))).\end{aligned} \tag{5.3.2}$$

The position and the presentation order of the events $E1$ and $E2$ in the narration, is irrelevant in order to have an anchoring for repetition. For example in *Pulp Fiction*, the last event of the robbery sequence at the bar, is anchored to an event located in the middle of the last film sequence. Similarly in *Before the rain* the story event of Zamira and Kiril in Macedonia, presented in first episode, is anchored to another event, located in the second episode. In *Memento*[12] instead, there are various deixis that are constructed for the repetition of the last event of a sequence Sx, with the first event of the sequence preceding Sx (see figure 7.7.2 in paragraph 7.7).

TEMPORAL DEIXIS THROUGH MEDIA. There are categories of deixis that occur for the existence of events indirectly that are reported in the diegesis through a media (radio, television photo and so on). These events, also if not directly presented in the diegesis are believed happen – this because according to the spectator, the media report always *true events*. Some examples of repetition through media are present in *Babel*[13], in one of them: a news bulletin report$_{e2}$ the news: "after the wounding of a tourist in Morocco

11 The following definition is valid:

$$\begin{aligned}&mev(Tx, bel(Spx, eq(E1, E2))) \leftarrow\\ &\ mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))),\\ &\ mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))),\\ &\ mev(Tx, bel(Spx, sameI([Td1, Td2], [Td3, Td4])))).\end{aligned} \tag{5.3.1}$$

12 [Memento]

13 Babel [Babel] is a film directed by Alejandro Gonzalez Inarritu, starring Brad Pitt, Cate Blanchett, and Gael García Bernal K.Yakusho. The film won the award for best director at the 2006 Cannes Film Festival.

there have been arrested$_{e4}$ two suspected – the shooting$_{e3}$ had happened in the mountainous area placed south of Ourzazate".

The wounding$_{e1}$ of a tourist is an event already presented in the story, and not repeated in the diegesis, but is indirectly reported (evoked) through a media (the television news service). In the example the event of the reporting news, has the same interval (immediately after, or in the same day) of the event crime occurred in the reality.

In the movie *Babel* $e3$ is reported as a just happened event, so $e2$ and $e3$ "approximately" happen in the same time interval of $e1$, and the events $e1$, $e2$, $e3$ are in this way anchored in the same day. The example of *Babel* sequence is captured by the following inference. Spx believes that $E1$ and $E2$ happen on same interval if Spx believes that: $E2$ happens on $[Td3, Td4]$; Mx takes part in the event $E2$; Mx is a media; Mx reports the event $E3$; $E1$ happens; and $E3$ and $E1$ are the same events. Formally:

$$\begin{aligned} & mev(Tx, bel(Spx, eq(E1, E2))) \ \leftarrow \\ & \ mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))), \\ & \ mev(Tx, bel(Spx, who(E2, Mx))), \\ & \ mev(Tx, bel(Spx, media(Mx))), \\ & \ mev(Tx, bel(Spx, what(E2, tell(Mx, E3)))), \\ & \ mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))), \\ & \ mev(Tx, bel(Spx, sameE(E3, E1))). \end{aligned} \tag{5.3.3}$$

Another example of repetition through media is present in *Before the rain*, when in the second episode is reported an event in which there is a photo of a girl killed – the event evokes another event happened in the story, already presented to the spectator (shown in the diegesis).

The model just given is applicable in those cases in which $E1$ has not been presented yet in the diegesis ($bel(Spx, E1)$), also in those cases in which $E1$ is described by some characters or by other media. A particular example of deixis just quoted is present in *Mistery Trains*, in which a radio message announce an Elvis Presley's song. This message (the same message) is reported (repeated) more times in different contexts of the story, with different characters and places. In that way the message has the function of synchronizing different episodes of the story, anchoring them on a same diegetic interval. This example leads to formulate a limit case, in which it is sufficient the condition that an event (also not directly happened in the diegesis) can be uttered through different media or persons in the different forms $E1$, $E2$,..., En (with $bel(Spx, sameE(E1, E2))$, $bel(Spx, sameE(E2, E3))$, ...,), to infer that those events happens on the same intervals ($bel(Spx, eq(E1, E2))$, $bel(Spx, eq(E2, E3))$,...,).

Lightly different is the inference if the news is narrated into past tense. Spx believes that $E1$ precedes $E2$ if Spx believes that: $E2$ happens on $[Td3, Td4]$; Mx takes part in the event $E2$; Mx is a media; Mx reports the events $E3$; $E3$ happens before $[Td3, Td4]$; $E1$ happens; and $E3$, $E1$ are the same events.

$$
\begin{aligned}
&mev(Tx, bel(Spx, prec(E1, E2))) \leftarrow \\
&\quad mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))), \\
&\quad mev(Tx, bel(Spx, who(E2, Mx))), \\
&\quad mev(Tx, bel(Spx, media(Mx))), \\
&\quad mev(Tx, bel(Spx, what(E2, tell(Mx, E3)))), \\
&\quad mev(Tx, bel(Spx, when(E3, before([Td3, Td4])))), \\
&\quad mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))), \\
&\quad mev(Tx, bel(Spx, sameE(E3, E1))).
\end{aligned}
\tag{5.3.4}
$$

In other words if the spectator believes that a media reports a news into the present tense, by using temporal expressions into the past, then the times, about the news facts, are antecedent to the present time in which the news is reported.

5.4 THE TEMPORAL ANCHORING FOR CAUSATION

In this paragraph, I introduce a rule of temporal anchoring, that several times is activated from the spectator in a movie story (this rule and has been already anticipated in this book).

For the construction of this rule, I started by a well-known axiom, existing in the theoretical researches on temporal reasoning[14] : if an event $E1$ causes an

14 The cognitive rule 5.4.1 is accepted in the most part of temporal causal theories, see in particular [Tooley2000] p. 268.

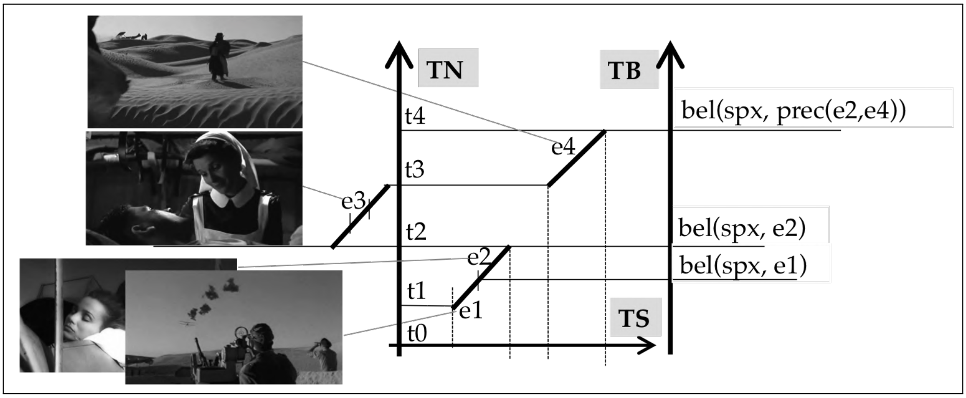


Figure 5.4.1: Causation of events in *The English Patient*

event E2 then E1 precedes E2. I have reformulated the rewriting of this axiom in cognitive terms (that is in terms of spectator's beliefs), in the following way:

$$
\begin{array}{ll}
\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2}))) \leftarrow & \text{\% Spx believes E1 precedes E2, if} \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{E1})), & \text{\% Spx believes that: E1 happens,} \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{E2})), & \text{\% E2 happens, and} \\
\quad \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{cause}(\mathsf{E1}, \mathsf{E2}))). & \text{\% E1 causes E2.}
\end{array}
\tag{5.4.1}
$$

In all the cases in which the event evoked is antecedent in the narration to the evoking event, the anchoring constitutes a proleptic deixis, on the contrary the anchoring is an analeptic deixis. An example of proleptic deixis for causation is present in the *English Patient*[15] – I give an example of the formalism

15 [TheEnglishPatient]

until here introduced to model the beginning sequences of this movie (see figure 5.4.1)

$$
\begin{array}{l}
mev(t1, bel(spx, when(e1, on([ta, tb])))).\\
mev(t1, bel(spx, what(e1, fly(plane)))).\\
mev(t1, bel(spx, who(e1, plane))).\\
mev(t1, bel(spx, who(e1, woman))).\\
\%-\\
mev(t2, bel(spx, when(e2, on([tc, td])))).\\
mev(t2, bel(spx, what(e2, hit(plane)))).\\
mev(t2, bel(spx, who(e2, plane))).\\
mev(t2, bel(spx, who(e2, pilot))).\\
mev(t2, bel(spx, where(e2, desert))).\\
\%-\\
mev(t3, bel(spx, when(e3, on([te, tf])))).\\
mev(t3, bel(spx, what(e3, travel(nurse, train)))).\\
mev(t3, bel(spx, who(e3, nurse))).\\
mev(t3, bel(spx, who(e3, soldiers))).\\
\%-\\
mev(t4, bel(spx, when(e4, on([tg, ti])))).\\
mev(t4, bel(spx, what(e4, shootdown(plane)))).\\
mev(t4, bel(spx, who(e4, plane))).\\
mev(t4, bel(spx, who(e4, rescuers))).\\
mev(t4, bel(spx, where(e4, desert))).
\end{array}
$$

The temporal anchoring rule for causation of events in this case uses the causal implication – $cause(e2, e4)$ – in which a machine gun shooting against an airplane (event $e2$) causes the shooting down of the same airplane (event $e4$). This causal connection generates spectator's belief:

$$mev(t4, bel(spx, prec(e2, e4))).$$

(spx believes that the event $e2$ precedes the event $e4$) through the instantiation of the inference 5.4.1 and the activation of the rules introduced in section 2.5.

In chapter 8 I will show that the cognitive rule of causation, just presented is not valid in a story with more courses of events, as for example in the cases in which there are time travels. In these cases if an event $E1$ is the travel of a machine going back in time and $E2$ is the first event in the past in which the machine has arrived, then also being the event $E1$ the cause of the event $E2$, the 5.4.1 can't be valid as it results that the $E1$ precedes $E2$, and that is untrue.

The spectator applies the causal temporal inference with very few consciousness, above all in all those cases in which $E1$ and $E2$ are visually contiguous. The little perception of causality among contiguous events is due to fact that the spectator often applies the rule of diegetic sequentiality for default (the inference 3.2.4 – presented in the paragraph 3.2), that is because the events are visually contiguous – without any cut – and the spectator has no reason to research a causal connection of the events presented in the diegesis. In the example of *The English Patient* given, the rule is applied between two events no visually contiguous – and it is in these cases that the spectator recurs to the causality, as there is an interruption of the story.

The rule of causality is always activated in all those cases in which the events $E1$ and $E2$, happening in the story, are not visually contiguous and the spectator can pinpoint a causal link for them.

There are cases in which the effect of the causal link (the event $E2$ in $cause(E1, E2)$) is not shown in the story – so the spectator sees in the diegesis $E1$, individuates a causal link for $E1$, with $E2$ not yet presented in the diegesis. Independently if $E1$,$E2$ and their causal link are relevant to the story, in this case it creates an expectation, due to a *prediction for causation*, in which the spectator expects $E2$ happening in the story. The considerations just given suggests a model composed of two spectator's cognitive activities: temporal relation between the time interval $[Td1, Td2]$ in which the expectation has born, and the interval in which this is satisfied.

1. for an event Ex uttered in the telling, the spectator Spx individuates a causal link – $bel(Spx, cause(Ex, Ey))$ – in which Ey has not been yet presented in the story. This situation generates a kind of expectation in Spx;
2. if after the step 1 the event Ey is presented in the narration then the spectator will apply an inference to establish a temporal relation between the time interval $[Td1, Td2]$, in which the expectation has born, and the interval in which this is finished.

For this cognitive activities I report two formal rules. The first rule is the following: Spx expects that an event $E2$ happens after $[Td1, Td2]$ if Spx believes that $\mathsf{E1}$ causes $\mathsf{E2}$; $\mathsf{E1}$ happens on $[\mathsf{Td1},\mathsf{Td2}]$, and $\mathsf{E2}$ has not happened.

$$\begin{aligned}
&mev(Tx, addBel(bel(Spx, expectE(E2, after([Td1, Td2]))))) \leftarrow\\
&\quad mev(Tx, bel(Spx, cause(E1, E2))),\\
&\quad mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))),\\
&\quad not\ mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))).
\end{aligned} \tag{5.4.2}$$

$mev(Tx, bel(Spx, expectE(E2, after([Td1, Td2]))))$ represents spectator's expectation that $\mathsf{E2}$ happens after $[\mathsf{Td1},\mathsf{Td2}]$.

The second rule represents the end of the expectation, that occurs when in the narration an event $\mathsf{E2}$ happens in a diegetic interval $[\mathsf{Td3},\mathsf{Td4}]$, generating the spectator's belief that: the interval $[\mathsf{Td1},\mathsf{Td2}]$, in which the expectation has been generated, it is antecedent to the interval $[\mathsf{Td3},\mathsf{Td4}]$ in which the expectation is finished. The cognitive rule is the following: Spx believes that $[\mathsf{Td1},\mathsf{Td2}]$ precedes $[\mathsf{Td3},\mathsf{Td4}]$ if Spx expects that the event $\mathsf{E2}$ happens after $[\mathsf{Td1},\mathsf{Td2}]$; and $\mathsf{E2}$ happens on $[\mathsf{Td3},\mathsf{Td4}]$.

$$\begin{aligned}
&mev(Tx, bel(Spx, prec([Td1, Td2], [Td3, Td4]))) \leftarrow\\
&\quad mev(Tx, bel(Spx, expectE(E2, after([Td1, Td2])))),\\
&\quad mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))).
\end{aligned} \tag{5.4.3}$$

In the case we are examining, the spectator's expectation of an event is independent by the causal belief that has generated it – this expectation could be determined by other circumstances not relating to causal implications – for example as in the following case we are going to discuss, where an expectation is generated in the spectator by an announcement of an event that will happen.

Spectator's expectation is removed if $\mathsf{E2}$ happens in the story:

$$\begin{aligned}
&mev(Tx, remBel(bel(Spx, expectE(E2, after([Td1, Td2]))))) \leftarrow\\
&\quad mev(Tx, bel(Spx, expectE(E2, after([Td1, Td2])))),\\
&\quad mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))).
\end{aligned} \tag{5.4.4}$$

Please note that every expectation state is not always satisfied. In *The Shawshank Redemption*, Andy is in a particular moment of discouragement due to the fact that another prisoner Tommy has been killed. Andy was friend and mentor of Tommy, this latter could introduce new facts to reopen Andy's trial, thus lead him to a sure release, but the prison director kills Tommy. In a scene it is shown Andy full of despondency. Andy asks a piece of rope to a prison mate, who without giving importance to that, takes it from the wardrobe and give it to him. These sequences creates an expectation – with the application of an obvious causal relation by the spectator, who believes Andy has the intention to hang himself – as it is known – in the story, it doesn't happen. Andy doesn't hang himself, that piece of rope will be used to escape.

All those cases, in which the spectator's expectations are not satisfied, as in the example given, generates a surprise[16] – the inference is the following: The spectator removes the expectation even if: expects that Ey happens after [Td1,Td2]; believes that Ez happens; believes that Ey and Ez are mutually exclusive.

$$\begin{aligned}&\mathsf{mev(Tx, remBel(bel(Spx, when(Ey, after([Td1, Td2])))))} \leftarrow\\ &\quad \mathsf{mev(Tx, bel(Spx, expectE(Ey, after([Td1, Td2])))),}\\ &\quad \mathsf{mev(Tx, bel(Spx, when(Ez, on([Td3, Td4])))),}\\ &\quad \mathsf{mev(Tx, bel(Spx, xor(Ey, Ez))),}\\ &\quad \mathsf{Ey! = Ez.}\end{aligned} \tag{5.4.5}$$

If the spectator Spx believes that events Ey and Ez are mutually exclusive, is also surprised:

$$\begin{aligned}&\mathsf{mev(Tx, addBel(Spx, surprise(Ez, Ey)))} \leftarrow\\ &\quad \mathsf{mev(Tx, bel(Spx, expectE(Ey, after([Td1, Td2])))),}\\ &\quad \mathsf{mev(Tx, bel(Spx, when(Ez, on([Td3, Td4])))),}\\ &\quad \mathsf{mev(Tx, bel(Spx, xor(Ey, Ez))).}\end{aligned} \tag{5.4.6}$$

Lastly, I give the model anchoring generated in the spectator when the effect of a determined cause is anticipated. I have called it **anchoring for antici-**

16 I have given a simply surprise model. In [Mele2002] some cognitive models relating to the expectation and surprise in relation to humour phenomena, have been presented. A dissertation of the surprise always from a cognitive point of view, is present in [Lorini2006].

pation of effect, regulated by the following inference: Spx expects that $E1$ happens before $[Td3, Td4]$ if Spx believes that: $E2$ happens on $[Td1, Td2]$; and $E1$ cause $E2$.

$$\begin{array}{l} mev(Tx, addBel(bel(Spx, expectE(E1, before([Td3, Td4]))))) \leftarrow \\ \quad mev(Tx, bel(Spx, cause(E1, E2))), \\ \quad mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))), \\ \quad not\ mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))). \end{array} \tag{5.4.7}$$

Spectator's implication, present in 5.4.7, regards an event $E1$ (not presented in the diegesis) that has happened in the past in the story (previous to $[Td3, Td4]$). The event $E1$ constitutes an expectation of presentation in the diegesis of an event. I have used the term "expectation", as the spectator expects that $E1$ is presented forward in the narration – even if he believes that $E1$ happens in a time previous to the event $E2$ in the story. When $E1$ happens (it is shown in the diegesis) the spectator creates an anchoring by means the following inference: Spx believes that $[Td3, Td4]$ precedes $[Td1, Td2]$ if Spx: expects that $E1$ happens before $[Td3, Td4]$; and believes that $E1$ happens on $[Td1, Td2]$.

$$\begin{array}{l} mev(Tx, bel(Spx, prec([Td1, Td2], [Td3, Td4]))) \leftarrow \\ \quad mev(Tx, bel(Spx, expectE(E1, before([Td3, Td4])))), \\ \quad mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))). \end{array} \tag{5.4.8}$$

Spectator's expectation is removed if $E1$ happens in the story:

$$\begin{array}{l} mev(Tx, remBel(bel(Spx, expectE(E1, before([Td3, Td4]))))) \leftarrow \\ \quad mev(Tx, bel(Spx, expectE(E1, before([Td3, Td4])))), \\ \quad mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))). \end{array} \tag{5.4.9}$$

5.5 THE TELLING OF CHARACTERS ABOUT EVENTS NOT YET SHOWN IN THE DIEGESIS

The telling of characters about events not yet shown (or that will never be shown) in the diegesis, is a form of staging, that activates many interpretative processes and hypothesis in the spectator, whom is asked an additional cognitive activity of revision, when the assumptions made are erroneous. In this scenery the crucial points of cognitive interest for the spectator are:

- the interpretation of the described events;
- the spectator acceptation of facts (events) shown in the diegesis;
- the generation of the expectations of some events;
- the recognizing that the events described by characters happen;
- the generation of eventual surprises in relation to expectations;
- the eventual temporal anchoring when an expectation is confirmed

In the next paragraphs, I report some models involving the cognitive aspects listed in the previous list.

5.5.1 A character tells that an event has happened

When a character Px tells another character Pa that a determined event has happened, then the spectator believes that such event has (really) happened in a story – he believes this, unless there aren't obvious circumstances that do let the same spectator believe that what reported by Px is not the truth (this circumstances are expressed in the model through the condition Cx). The inference scheme regulating the act of the character's telling, is the following:

$$
\begin{array}{l}
mev(Tx, bel(Spx, when(Ex, before([Td1, Td2])))) \ \leftarrow \\
\quad mev(Tx, bel(Spx, when(Vdx, on([Td1, Td2])))), \\
\quad mev(Tx, bel(Spx, who(Vdx, Px))), \\
\quad mev(Tx, bel(Spx, what(Vdx, tell(Px, when(Ex, before([Td1, Td2])))))), \\
\quad not\ cPxPa(Tx, Spx, Ex, Px).
\end{array}
\qquad (5.5.1)
$$

$$\begin{aligned}&\mathit{mev}(Tx, bel(Spx, when(Ex, after([Td1, Td2])))) \leftarrow\\&\quad \mathit{mev}(Tx, bel(Spx, when(Vdx, on([Td1, Td2])))),\\&\quad \mathit{mev}(Tx, bel(Spx, who(Vdx, Px))),\\&\quad \mathit{mev}(Tx, bel(Spx, what(Vdx, tell(Px, when(Ex, after([Td1, Td2])))))),\\&\quad not\ cPxPa(Tx, Spx, Ex, Px).\end{aligned} \tag{5.5.2}$$

$$\begin{aligned}&\mathit{mev}(Tx, bel(Spx, what(Ex, Az))) \leftarrow\\&\quad \mathit{mev}(Tx, bel(Spx, what(Vdx, tell(Px, what(Ex, Az))))),\\&\quad \mathit{mev}(Tx, bel(Spx, who(Vdx, Px))),\\&\quad not\ cPxPa(Tx, Spx, Ex, Px).\end{aligned} \tag{5.5.3}$$

$$\begin{aligned}&\mathit{mev}(Tx, bel(Spx, who(Ex, Pa))) \leftarrow\\&\quad \mathit{mev}(Tx, bel(Spx, who(Vdx, Px))),\\&\quad \mathit{mev}(Tx, bel(Spx, what(Vdx, tell(Px, who(Ex, Pa))))),\\&\quad not\ cPxPa(Tx, Spx, Ex, Px).\end{aligned} \tag{5.5.4}$$

$$\begin{aligned}&\mathit{mev}(Tx, bel(Spx, where(Ex, Wr))) \leftarrow\\&\quad \mathit{mev}(Tx, bel(Spx, who(Vdx, Px))),\\&\quad \mathit{mev}(Tx, bel(Spx, what(Vdx, tell(Px, where(Ex, Wr))))),\\&\quad not\ cPxPa(Tx, Spx, Ex, Px).\end{aligned} \tag{5.5.5}$$

The inferences 5.5.1, 5.5.2, 5.5.3, 5.5.3 5.5.4, and 5.5.5 have in common the following conditions: the spectator Spx believes that exists an event Vdx happening on $[Td1, Td2]$, Px is an participant in the event Vdx, and the ”what” of the event Vdx is an action of the telling of Px.

If the telling of Px describes an event Ex will happen in the story in an past interval (as in the case of inference 5.5.1) then the spectator Spx believes that Ex have happened in the story before $[Td1, Td2]$ (temporal interval where the telling is reported by Px). The inference 5.5.2 formalizes the case where the event described has happened in the future. I will discuss these types of filmic enunciations in the next paragraph.

If the telling of Px describes an action Az as the ”what” component of a event Ex, then the spectator Spx believe that an event Ex with an Az action occurred. (inference 5.5.3).

If the telling of Px describes another character Pa, as the "who" component of a event Ex, then the spectator Spx believe that an event Ex with a participant Pa occurred (inference 5.5.4).

Finally, if the telling of Px describes a place, as the "where" component of a event Ex, then the spectator Spx believes that an event Ex happened in Wr (inference 5.5.5).

The condition $not\ cPxPa(Tx, Spx, Ex, Px)$ is a complex one that could be determined by what previously happened in the events that had Px as a participant, but also by what the spectator knows about other events he believes have happened, and that are in relation to, or in conflict with Ex, where the latter event constitutes the version of the facts according to Px. For example could be valid the implication: $cPxPa(Tx, Spx, Ex, Px)$ is true if Spx believes that Px is a liar. Formally:

$$\begin{aligned} &cPxPa(Tx, Spx, Ex, Px) \leftarrow \\ &\quad mev(Tx, bel(Spx, propEv(Ex, prop(liar, Px, yes)))). \end{aligned} \tag{5.5.6}$$

$cPxPa(Tx, Spx, Ex, Px)$ could also be true if Spx believes that another character Pa believes that Px is a liar; and Spx believes Pa is not a liar.

$$\begin{aligned} &cPxPa(Tx, Spx, Ex, Px) \leftarrow \\ &\quad mev(Tx, bel(Spx, who(Pa, Ex))), \\ &\quad mev(Tx, bel(Spx, bel(Pa, propEv(Ex, prop(liar, Px, yes))))), \\ &\quad mev(Tx, bel(Spx, propEv(Ex, prop(liar, Pa, not)))). \end{aligned} \tag{5.5.7}$$

In other words $cPxPa(Tx, Spx, Ex, Px)$ represents the *resistance* of the spectator (and not only, also of Pa) to take as truth, what the character Px says (regarding the conditions type $cPxPa(Tx, Spx, Ex, Px)$ I will come back to the argument in the paragraph 6.1 with a formal definition). If the conditions of inferences 5.5.1, 5.5.3, 5.5.3, 5.5.4, and 5.5.5 are satisfied, then the spectator believes that the event Ex has happened in the story on a diegetic interval previous to the one in which the event Ex has been described by Px, and that the action of this event is just the action Az described.

After that in the cognitive state of the spectator, has been generated the belief that a determined event has happened in the past, when an event Ey

appears in the story ($mev(Tx, bel(Spx, when(Ex, before([Td1, Td2])))))$), and the spectator believes that is the same as Ex, a temporal anchoring determined by the following cognitive rule, is generated: Spx believes that $[Td3, Td4]$ precedes $[Td1, Td2]$ if Spx believes: Ex happens before $[Td1, Td2]$; Ey happens on $[Td3, Td4]$, and Ex, Ey are the same events.

$$\begin{aligned} & mev(Tx, bel(Spx, prec([Td3, Td4], [Td1, Td2]))) \leftarrow \\ & \quad mev(Tx, bel(Spx, when(Ex, before([Td1, Td2])))), \\ & \quad mev(Tx, bel(Spx, Ey)), \\ & \quad mev(Tx, bel(Spx, when(Ey, on([Td3, Td4])))), \\ & \quad mev(Tx, bel(Spx, sameE(Ex, Ey))). \end{aligned} \tag{5.5.8}$$

Two filmic sequences modelled through the latest two inferential rules introduced, are present in the movie *Memento*. In a sequence – Natalie in a bar tells to Leonard “take your keys you forgot at my place” (the utterance place is the bar – the spectator infers that “Leonard has been to Natalie’s house” (inference 5.5.8). In another sequence, later in the narration, it is shown Leonard at Natalie’s house, the spectator infers that the diegetic interval of the episode “Leonard at Natalie’s house” is antecedent to the one of Leonard into the bar” (inference 5.5.8). The events declared “happened” by a character don’t generate a true expectation, as the ones declared to happen in future, notwithstanding when they are present in the diegesis they constitute cognitive hooks that can be used after in the narration to create a temporal anchoring. The inference 5.5.8 above reported in synthetics terms is uttered: the diegetic interval in which an event happens is antecedent to the interval in which the event has been reported as happened.

5.5.2 A character says an event will happen

A diegetic voice always speaks at a present tense, it describes diegetic events that can be collocated forward or in the past – while an extradiegetic voice always speaks from a future time (using a past tense) and collocates in the past the events that on that moment appear on the screen[17]. I discuss the case

17 An extradiegetic voice can perform also comments on characters and on their qualities, and it can report the thought of the characters – in this book I only have examined the effect this voice provokes when generating spectator’s beliefs on temporal relation among the events.

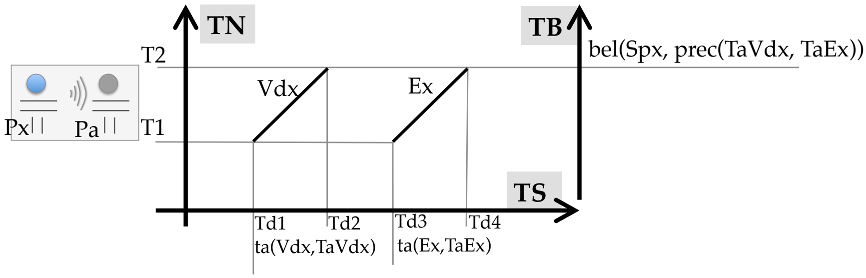


Figure 5.5.1: A diegetic voice stating an event that will happen

of a character Pa telling to another character Pb that a determined event Ex will happen. The characteristic inference for such a type filmic situation is the rule 5.5.2 (reported in the previous paragraph). Even for descriptions of future events, the inferences 5.5.3, 5.5.4, and 5.5.5 are valid.

The expression $\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ex}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}]))))$ in 5.5.2 suggests that the speaking of an happened event not shown in the diegesis, generates a particular expectation in the spectator Spx compared to the event Ex – Spx expects that an event Ex happens in an interval future to ($[\mathsf{Td1}, \mathsf{Td2}]$), having a specified action Az. The expectation ceases to exist, when in the story happens an event Ey that is the same expected event Ex ($\mathsf{bel}(\mathsf{Spx}, \mathsf{sameE}(\mathsf{Ey}, \mathsf{Ex}))$). The cognitive rule is the following: the spectator Spx removes an expectation of an event Ex and believes that the $[\mathsf{Td1}, \mathsf{Td2}]$ precedes $[\mathsf{Td3}, \mathsf{Td4}]$ if: Spx believes that after $[\mathsf{Td1}, \mathsf{Td2}]$ an event expectation for Ex exists; an event Ey happens on $[\mathsf{Td3}, \mathsf{Td4}]$; and Ey and Ex are the same events. Formally:

$$\begin{aligned}
&\mathsf{mev}(\mathsf{Tx}, \mathsf{remBel}(\mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ex}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}]))) \leftarrow \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ex}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}])))), \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ey}, \mathsf{on}([\mathsf{Td3}, \mathsf{Td4}])))), \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{sameE}(\mathsf{Ey}, \mathsf{Ex}))).
\end{aligned} \tag{5.5.9}$$

$$\begin{aligned}
&\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}([\mathsf{Td1}, \mathsf{Td2}], [\mathsf{Td3}, \mathsf{Td4}]))) \leftarrow \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ex}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}])))), \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{when}(\mathsf{Ey}, \mathsf{on}([\mathsf{Td3}, \mathsf{Td4}])))), \\
&\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{sameE}(\mathsf{Ey}, \mathsf{Ex}))).
\end{aligned} \tag{5.5.10}$$

The inferences reported are temporal anchoring that can be qualitatively synthesized in the following way: the beginning time of an expectation of an event is always previous to the time in which the event happens. Definitively, the anchoring is recorded by the spectator through three phases: the first consists in the recording of a linguistic act of a character Px in declaring to another character Pa, that an event Ex will happen; the second with a generation of an expectation of the spectator, in which he believes that the event Ex, described by Px, will happen in future; the third instead, consists in determining that an event Ey happening in the diegesis, is identical to Ex (the one described by Px) – and that the expectation is satisfied.

Through these three steps, so the spectator establishes a temporal anchoring: he believes that exists a relation of temporal precedence between the interval in which the expectation has been generated, and the interval in which the expectation is confirmed.

5.5.3 A character says an action will happen

There are expectations in the spectator that are generated not only if a character Px tells that an event (he believes that) will happen later in the story, but also in relation to a "telling" of a character Px, who commits himself with another character Pa to execute a determined action Az, he will perform. I present a model that can be adopted in many ordinary situations of a story, as the saying of making a journey, promising of visiting someone, committing to retrieve an object and so on. In all these diegetic events the spectator believes that what said or promised by a character will happen – this independently if the promise of the character Px, to perform the action, is maintained or not. The inference group modeling a character's saying that an action will occur is as follows:

$$\begin{array}{l}
mev(Tx, bel(Spx, when(Ex, after([Td1, Td2])))) \leftarrow \\
\quad mev(Tx, bel(Spx, when(Vdx, on([Td1, Td2])))), \\
\quad mev(Tx, bel(Spx, who(Vdx, Px))), \\
\quad mev(Tx, bel(Spx, what(Vdx, tell(Px, when(Ex, after([Td1, Td2])))))), \\
\quad mev(Tx, bel(Spx, what(Vdx, tell(Px, what(Ex, Az))))), \\
\quad mev(Tx, bel(Spx, what(Vdx, tell(Px, who(Ex, Px))))), \\
\quad mev(Tx, bel(Spx, what(Vdx, tell(Px, prop(agent, Px, Az))))), \\
\quad not\ cPxPa2(Tx, Spx, Ex, Px).
\end{array}$$

$$\tag{5.5.11}$$

$$\begin{aligned}
&\mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Ex}, Az))) \leftarrow \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{when}(\mathsf{Vdx}, \mathsf{on}([\mathsf{Td1}, \mathsf{Td2}])))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{who}(\mathsf{Vdx}, \mathsf{Px}))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathit{when}(\mathsf{Ex}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}])))))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathit{what}(\mathsf{Ex}, Az))))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathit{who}(\mathsf{Ex}, \mathsf{Px}))))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathsf{prop}(\mathsf{agent}, \mathsf{Px}, Az))))), \\
&\quad \mathsf{not}\ \mathsf{cPxPa2}(\mathsf{Tx}, \mathsf{Spx}, \mathsf{Ex}, \mathsf{Px}).
\end{aligned}\tag{5.5.12}$$

$$\begin{aligned}
&\mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{who}(\mathsf{Ex}, \mathsf{Px}))) \leftarrow \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{when}(\mathsf{Vdx}, \mathsf{on}([\mathsf{Td1}, \mathsf{Td2}])))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{who}(\mathsf{Vdx}, \mathsf{Px}))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathit{when}(\mathsf{Ex}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}])))))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathit{what}(\mathsf{Ex}, Az))))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathit{who}(\mathsf{Ex}, \mathsf{Px}))))), \\
&\quad \mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathit{what}(\mathsf{Vdx}, \mathsf{tell}(\mathsf{Px}, \mathsf{prop}(\mathsf{agent}, \mathsf{Px}, Az))))), \\
&\quad \mathsf{not}\ \mathsf{cPxPa2}(\mathsf{Tx}, \mathsf{Spx}, \mathsf{Ex}, \mathsf{Px}).
\end{aligned}\tag{5.5.13}$$

The conditions of rule 5.5.11 generate an expectation (weak or strong it doesn't matter) in the spectator, who believes that the action Az (see 5.5.12) will execute by a character Px (see 5.5.13), and the event $\mathsf{E1}$ will happen in the story after interval $[\mathsf{Td1}, \mathsf{Td2}]$ (interval in which Px promise to performe Az. The inference 5.5.11 is similar to the expectation 5.5.9 generated by the words of a character telling that a determined event will happen. After that a character tells that will carry out an action, the spectator is in an expectation state – $\mathsf{bel}(\mathsf{Spx}, \mathit{when}(\mathsf{E2}, \mathsf{after}([\mathsf{Td1}, \mathsf{Td2}])))$ – in such way there are the conditions to apply the inference and for inferring the anchoring $\mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2}))$[18].

18 If the spectator believes that the event $\mathsf{E1}$ corresponding to action Az will cause another event $\mathsf{E3}$ $\mathit{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{cause}(\mathsf{E1}, \mathsf{E3})))$ and Spx also believes that Px believes it

5.6 DEIXIS BASED ON TEMPORAL RIGID EVENTS

There are some deixis (fittings) that a spectator activates because in the diegesis are present two events, that for their intrinsic meaning, have a rigid relation of temporal order, that cannot be inverted if the events are presented in a differente order in the narration. "The being alive of a person" for example always precedes the "being dead", "being a child precedes "being old" and so on. These events are responsible of the construction in the spectator of deiptic rules that often are employed in the link of story events, not yet temporally connected. If for example in relation to an event $E1$ the spectator Spx believes in an interval a determined character Px is dead, and in relation to another event $E2$, he believes that the same character is alive, then the spectator believes that $E2$ precedes $E1$. The rule is the following: Spx believes that $E2$ precedes $E1$ if Px takes part to $E1$; Py takes part to $E2$; in $E1$ Px is dead; in $E2$ Px is alive; Py and Px are the same characters. In a formal way:

$$
\begin{aligned}
&mev(Tx, bel(Spx, prec(E2, E1))) \leftarrow \\
&\quad mev(Tx, bel(Spx, who(E1, Px))), \\
&\quad mev(Tx, bel(Spx, who(E2, Py))), \\
&\quad mev(Tx, bel(Spx, propEv(E1, prop(physical\_condition, Px, dead)))), \\
&\quad mev(Tx, bel(Spx, propEv(E2, prop(physical\_condition, Py, alive)))), \\
&\quad mev(Tx, bel(Spx, sameP(Py, Px))).
\end{aligned}
\tag{5.6.1}
$$

$(mev(Tx, bel(Spx, bel(Px, cause(E1, E3)))))$, then Spx believes that the event $E3$ (the effect of E1) will happen after $after([Td1, Td2])$. Formally the rule is:

$$
\begin{aligned}
&mev(Tx, bel(Spx, where(E3, after([Td1, Td2])))) \leftarrow \\
&\quad mev(Tx, bel(Spx, where(E2, on([Td1, Td2])))), \\
&\quad mev(Tx, bel(Spx, who(E2, Px))), \\
&\quad mev(Tx, bel(Spx, what(E2, tell(Px, when(E1, after([Td1, Td2])))))), \\
&\quad mev(Tx, bel(Spx, what(E2, tell(Px, what(E1, do(Px, Az)))))), \\
&\quad mev(Tx, bel(Spx, what(E2, tell(Px, who(E1, Px))))), \\
&\quad mev(Tx, bel(Spx, what(E1, Az))), \\
&\quad mev(Tx, bel(Spx, cause(E1, E3))), \\
&\quad mev(Tx, bel(Spx, bel(Px, cause(E1, E3)))).
\end{aligned}
\tag{5.5.14}
$$

Figure 5.6.1: Sequence of the watch delivery to Bucth in *Pulp Fiction*

This inference is always valid, and it is independent by the order of presentation and by the distance of $E1$ and $E2$ in the narration. I underline that in the temporal deixis the events $E1$ and $E2$ don't present a visual contiguity.

There exist other rules of inference similar to the previous regarding other two properties, in which the age of the character impose a rigidity on the temporal order of the events. For example for the the couple of properties "being old" and "being young", is valid: Spx believes that $E2$ precedes $E1$ if Spx believes that: $E1$ happens; $E2$ happens; Px takes part to $E1$; Py takes part to $E2$; $E1$ and $E2$ are visually contiguos; in $E1$ Px is old; in $E2$ Py is young; and Px and Py are the same characters.

$$
\begin{aligned}
&\mathit{mev}(Tx, bel(Spx, prec(E2, E1))) \leftarrow \\
&\quad \mathit{mev}(Tx, bel(Spx, who(E1, Px))), \\
&\quad \mathit{mev}(Tx, bel(Spx, who(E2, Py))), \\
&\quad \mathit{mev}(Tx, bel(Spx, propEv(E1, prop(age, Px, old)))), \\
&\quad \mathit{mev}(Tx, bel(Spx, propEv(E2, prop(age, Py, young)))), \\
&\quad \mathit{mev}(Tx, bel(Spx, sameP(Px, Py))).
\end{aligned}
\tag{5.6.2}
$$

In the same way for the properties "being adult" – "being a child", is valid: Spx believes that $E2$ precedes $E1$, if Spx believes that: Px takes part to $E1$;

Py takes part to $\mathsf{E2}$; $\mathsf{E1}$ and $\mathsf{E2}$ are visually contiguous; in $\mathsf{E1}$ Px is adult; in $\mathsf{E2}$ Py is child; Px and Py are the same characters.

$$\begin{aligned}&\mathsf{mev(Tx, bel(Spx, prec(E2, E1)))} \leftarrow\\ &\;\mathsf{mev(Tx, bel(Spx, who(E1, Px)))},\\ &\;\mathsf{mev(Tx, bel(Spx, who(E2, Py)))},\\ &\;\mathsf{mev(Tx, bel(Spx, propEv(E1, prop(age, Px, adult))))},\\ &\;\mathsf{mev(Tx, bel(Spx, propEv(E2, prop(age, Py, child))))},\\ &\;\mathsf{mev(Tx, bel(Spx, sameP(Px, Py)))}.\end{aligned} \tag{5.6.3}$$

This latest inference, permits us to model a well-known flashforward in *Pulp Fiction*, that happens between the sequence of the delivery of the watch ($\mathsf{e1}$), in which a lady (maybe his mother) calls a child ($\mathsf{p1}$) by name (Butch) – and the following one in which a boxer wakes up in the bed of the changing room before the match, and soon after is called by the same name. Before applying

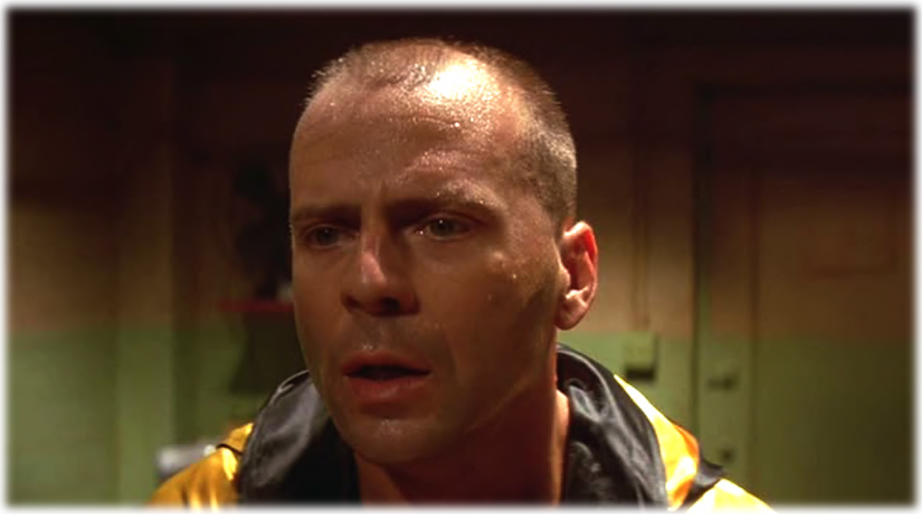


Figure 5.6.2: The awakening of Butch before of the boxing match in *Pulp Fiction*

the rule 5.6.3, it occurs the inference 2.4.9, introduced in the section that leads the spectator to believe that there is identity between the two persons "Butch as a child and Butch old". As until the respective points of the telling, the spectator Spx didn't know the names of the characters, I make the hypothesis that Spx has adopted in his mental representation, respectively the epithets – "the child" and the "boxeur" on these two values I give the rule 2.4.9:

$$\begin{aligned}
&mev(t1, bel(spx, sameP(p1, p2))) \leftarrow \\
&\;mev(t1, bel(spx, who(e1, p1))), \\
&\;mev(t1, bel(spx, who(e2, p2))), \\
&\;mev(t1, bel(spx, propEv(e1, prop(name, p1, "Butch")))), \\
&\;mev(t1, bel(spx, propEv(e2, prop(name, p2, "Butch")))), \\
&\;mev(t1, bel(spx, sameV("Butch", "Butch"))).
\end{aligned} \tag{5.6.4}$$

For the case we are examining, we can complete the deductive chain of the spectator by instantiating the rule 5.6.3:

$$\begin{aligned}
&mev(t2, bel(spx, prec(e2, e1))) \leftarrow \\
&\;mev(t2, bel(spx, who(e1, the_Boxer))), \\
&\;mev(t2, bel(spx, who(e2, the_child))), \\
&\;mev(t2, bel(spx, propEv(e1, prop(age, the_child, child)))), \\
&\;mev(t2, bel(spx, propEv(e2, prop(age, the_boxer, adult)))), \\
&\;mev(t2, bel(spx, sameP(the_child, the_boxer)))).
\end{aligned} \tag{5.6.5}$$

There are rigid deixis, through which from knowledges on characters' roles are inferred relations on the temporal order of events. As example for the discussion, I have chosen a deixis occurring in *21 grams*. In a point of the telling, Paul and Cristina are sitting in a car, while discuss in a confidential and intimate manner, typical of two lovers (in figure 5.6.3 to be considered the sequence Sn). Paul besides being Cristina's lover, feels him in debt with Michael (husband died of Cristina) – as this latter is the person who has given a new hearth to Paul. The sequence is interrupted from Cristina's request of killing Jack Jordan, the person who has killed in a car crash, her husband Michael and her daughters. After various sequences where other events are presented in the story, the story of Paul and Cristina is resumed. In a first moment Paul spies Cristina while hiding himself, then Paul decides to enter in the same shop in which there is also Cristina (in figure 5.6.3 consider the sequence Sv). In the shop are framed Paul and Cristina near the checkout – the two in this part in the story show not to know each other. The spectator

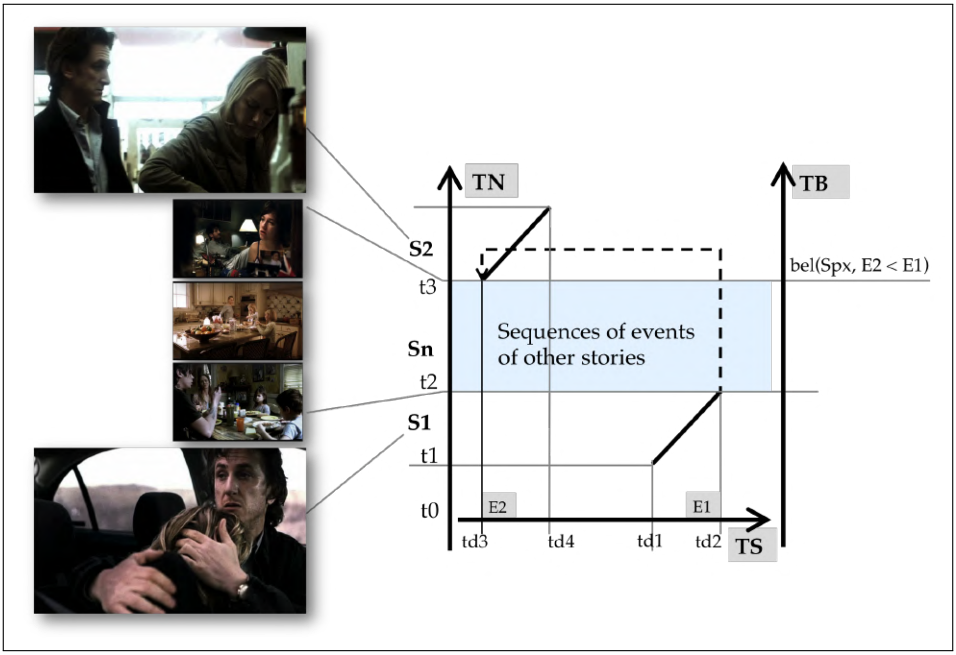


Figure 5.6.3: Example of deixis activated from the roles and relationships among the characters in *21 Grams*

acquires a temporal belief with an event $Ev2$, applying the cognitive rule establishing that the temporal interval in which two persons are strangers (event $Ev2$), is antecedent to the interval in which the persons know each other – as in the case of the event $Ev1$ (in it Paul and Cristina are lovers). Formally I represent the inferential deductive chain of the spectator through three inferences.

Rule 1 - Spx believes in $E1$ Px knows Py if Spx believes that: Px takes part to $E1$; Py takes part to $E2$; and in $E1$ Px is lover of Py.

$$\begin{aligned}&mev(Tx, bel(Spx, what(E1, know(Px, Py)))) \leftarrow\\&\;mev(Tx, bel(Spx, who(E1, Px))),\\&\;mev(Tx, bel(Spx, who(E2, Py))),\\&\;mev(Tx, bel(Spx, roleEv(E1, rol(lover, Py, Px)))).\end{aligned} \tag{5.6.6}$$

The inference 5.6.6 establishes (banally) that if two persons are lovers then they must know each others[19].

Rule 2 - Spx believes that in $E2$ Px does not know Py if Spx believes that: Px takes part to $E2$, Py takes part to $E2$, and Px does not greet Py[20].

$$\begin{array}{l} mev(Tx, bel(Spx, what(E2, not\_know(Px, Py)))) \leftarrow \\ \quad mev(Tx, bel(Spx, who(E2, Px))), \\ \quad mev(Tx, bel(Spx, who(E2, Py))), \\ \quad mev(Tx, bel(Spx, what(E2, not\_greet(Px, Py)))). \end{array} \tag{5.6.8}$$

The inference 5.6.8 regards a praxis rule (for the inference rules for praxis, see next paragraph) according at this, if two persons don't greet each other, then they don't know each other.

Rule 3 - Spx believes that $E2$ precedes $E1$ if Spx believes that: in $E1$ Px knows Py, in $E2$ Px does not know Py.

$$\begin{array}{ll} mev(Tx, bel(Spx, prec(E2, E1))) \leftarrow & \\ \quad mev(Tx, bel(Spx, what(E1, know(Px, Py)))), & \\ \quad mev(Tx, bel(Spx, what(E2, not\_know(Px, Py)))), & \text{\% Spx believes that are} \\ \quad not\ mev(Tx, bel(Spx, sameE(E1, E2))). & \text{\% not the same events.} \end{array} \tag{5.6.9}$$

The inference 5.6.9 describes the rule that the time interval where two persons don't know each other, is antecedent to the one in which the person it

19 Obviously there are many inferences that lead to the $know(Px, Py)$ conclusion that two people know each other (they are friends, relatives, colleagues, etc.), I have chosen the rule 5.6.6 as useful for the example we are dealing with.

20 I have defined two auxiliary definitions:

$$\begin{array}{l} mev(Tx, bel(Spx, what(E2, not\_know(Px, Py)))) \leftarrow \\ \quad not\ mev(Tx, (bel(Spx, what(E2, know(Px, Py))), \\ \quad mev(Tx, bel(Spx, who(E1, Px))), \\ \quad mev(Tx, bel(Spx, who(E2, Py))), \\ \quad diegeticEvent(E1). \\ mev(Tx, bel(Spx, what(E2, not\_greet(Px, Py)))) \leftarrow \\ \quad not\ mev(Tx, bel(Spx, what(E2, greet(Px, Py)))), \\ \quad mev(Tx, bel(Spx, who(E1, Px))), \\ \quad mev(Tx, bel(Spx, who(E2, Py))), \\ \quad diegeticEvent(E1). \end{array} \tag{5.6.7}$$

know each other. I desire underline that the temporal anchoring happening between the sequences $\mathsf{S1}$ and $\mathsf{S2}$ (see figure 5.6.3) is a deixis for analeptic evocation that is, the story comes back in the time, also if the events are not visually contiguous in the telling. The rigid deixis (as also other kind of deixis) are used in many flashback and flashforward (external or of thought) – this doesn't involve that the latter come under the deixis categories. I remember that the flashbacks and flashforwards interrupt the current story and the event on which the anchoring happens is visually contiguous to the current one. The deictic rigid inferences are used also in many implicit ellipsis, signaling that the story has temporally gone on, in this case these ellipsis maintain their structural identity as – in addition to interrupt the story, are characterized by the lack of causality among events determining then a fracture of the story.

INFERENCES OF TEMPORAL ORDER FOR PRAXIS. In the context of real life and in consequence in those of the movie stories, there are some links weaker than those causal, that bring to establish a relation of consequentiality between two events. Those links, in the daily real context have many synonyms as "for praxis", "generally", "customary", "habitually", "as rule" and other similar. Example of these rules are:

- a man (for praxis) enters firstly in a bathroom then he goes out;
- a person (for rule) first pays the cinema ticket, then enters in the room to watch the movie;
- two persons meeting (for praxis, habits, or custom) first greet each other then begins chatting;
- the prayer (for praxis) is said before the beginning of a meal;
- two persons (for rule) when they do not know each other, use the polite form, then when they become acquainting they speak informally.

Between two events $\mathsf{E1}$ and $\mathsf{E2}$ linked by a spectator's belief on a praxis relation ($\mathsf{mev(Tx, bel(Spx, seqForPraxis(E1, E2)))}$), the spectator establishes a temporal belief on temporal order between $\mathsf{E1}$, $\mathsf{E2}$ ($\mathsf{prec}(\mathsf{E1},\mathsf{E2})$) through the following inference:

$$\begin{aligned}&\mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{prec}(\mathsf{E1},\mathsf{E2}))) \leftarrow \\ &\quad \mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{E1})), \\ &\quad \mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{E2})), \\ &\quad \mathsf{mev}(\mathsf{Tx},\mathsf{bel}(\mathsf{Spx},\mathsf{seqForPraxis}(\mathsf{E1},\mathsf{E2}))).\end{aligned} \tag{5.6.10}$$

The rules for praxis applied by the spectator sometimes are false (the praxis sometimes in determined contexts is not respected) – the spectator, also in this case, is always ready to retract their registration of relative beliefs, especially if in the story emerge some elements that are in conflict with the assumptions made.

ON THE IMPOSSIBILITY TO CREATE ANCHORAGES. In addition to the hypothetical ellipsis, where some events temporarily are not anchored for lack of causal links (hypotetical ellipsis), in some stories the spectator isn't able to capture a temporal relation among the events, for the impossibility to believe that two events $\mathsf{E1}$ and $\mathsf{E2}$ can belong to a same course of event or a same story. This occurs, for example when $\mathsf{E1}$ and $\mathsf{E2}$ are incompatible (in the same story cannot exist together). Regarding this mental states, sometime the spectator puts the events $\mathsf{E1}$ and $\mathsf{E2}$ in two (separated) alternative courses of events. About these latest two deixis I will discuss deeply in chapter 8, in which I dealt with counterfactual stories.

In the end, there are some stories presenting multiple anchoring, for example when is reported in the telling two events $\mathsf{E1}$ and $\mathsf{E2}$ that let the spectator believe that $\mathsf{E1}$ precedes $\mathsf{E2}$, and for other reasons the exact opposite that $\mathsf{E2}$ precedes $\mathsf{E1}$. I will discuss these stories in the paragraphs 7.9 and 7.10, dedicated to the open stories.

5.7 NO TEMPORAL DEIXIS

Generally, no temporal deixis regard all the spectator's inferences that no generates a belief on temporal order among events. A particular kind of temporal deixis regards the properties of a character in the story, with the properties of another character. For these inferences, as in other kinds of deixis, there are two phases of cognitive activity:

1. At time Tx of the narration, building of beliefs Bi on the properties of characters or events, through explicit or implicit utterances in the story;
2. At time Ty of the narration (with $Tx < Ty$) building of new beliefs Bj on the properties of characters or events (as in 1) and comparison with the beliefs Bi acquired in phase 1.

No temporal deictic rules are formulated with conditions (premises) constituted by predicates regarding properties present in the utterances 1 and 2, and are activated after the utterances in 1. In addition to the properties believed truth by the spectator in phase 1, new characters' properties can be inferred, also with conditions that have not the sufficienc (I will call the relative conclusion *weak inference*), so as formulated in paragraph 1.3. These properties can be confirmed or retracted in phase 2. The confirmation happens through explicit or implicit utterance of the same properties that is referred by a character or reported through a media.

A deictic *weak* inference, used frequently by the spectator, leads to suppose that the characters having the same properties are the same characters[21]: Spx believes that in $E2$ $P1$ and $P2$ are the same characters if Spx believes that:

---

21 The notion of identity is known in Logic and Philosophy. C. Cozzo in a work present on line [Cozzo] writes: one have ascribed to Leibniz the following principle that for Tarsky is "the most important rule on identity":

$$\begin{array}{lll} x \text{ is } y & =_{def} & \text{\% two objects are identical iff} \\ x \text{ has every properties that has } y & \wedge & \\ y \text{ has every properties that has } x & & \end{array}$$

The principle has been split into two rules inferential:

$$\begin{array}{ll} x \text{ is } y & \Leftarrow \\ x \text{ has every properties that has } y & \wedge \\ y \text{ has every properties that has } x & \end{array} \tag{5.7.1}$$

The 5.7.1 is known as the principle of indiscernibility of the identical – if two objects have the same properties then they are identical:

$$\begin{array}{ll} x \text{ is } y & \Rightarrow \\ x \text{ has every properties that has } y & \wedge \\ y \text{ has every properties that has } x & \end{array} \tag{5.7.2}$$

$P1$ takes part to $E1$; $P2$ takes part to $E2$; in $E1$ the property $RelPro1$ of $P1$ is valid; in $E2$ the property $RelPro2$ of $P2$ is valid; $RelPro1$ and $RelPro2$ are the same property; $V1$ and $V2$ have the same values; the condition cpp is valid. In a formal way:

$$\begin{array}{l} mev(Tx, bel(Spx, sameP(P2, P1))) \leftarrow \\ \quad mev(Tx, bel(Spx, who(E1, P1))), \\ \quad mev(Tx, bel(Spx, who(E2, P2))), \\ \quad mev(Tx, bel(Spx, propEv(E1, prop(RelPro1, P1, V1)))), \\ \quad mev(Tx, bel(Spx, propEv(E2, prop(RelPro2, P2, V2)))), \\ \quad mev(Tx, bel(Spx, sameR(RelPro1, RelPro2))), \\ \quad mev(Tx, bel(Spx, sameV(V1, V2))), \\ \quad cpp(Tx, Spx, RelProp1). \end{array} \tag{5.7.3}$$

To reach the sufficiency in the inference 5.7.3, I believe that there are various type of assumptions for the condition cpp, for example:

$$\begin{array}{l} cpp(Tx, Spx, RelProp1) \leftarrow \\ \quad mev(Tx, bel(Spx, sing(RelPro1))). \end{array} \tag{5.7.4}$$

condition that represents spectator's belief that the property $RelPro1$ is singular, that is a property deviating from the norm – for example a character with a only arm, with a gash on his face, a horse voice or cavernous voice.

This singular condition ensures that for other mutual properties (for example a man with two arms, or with two eyes) the spectator can't reach to the conclusion of the 5.7.3. It could anyway happen that the properties $RelPro1$, also for the close world of fiction considered, is not enough specifies, and that so the spectator can reach to erroneous conclusions. This, as referred many times in this book, does not undermine the basis of the deductive apparatus proposed – in it are present revision rules of the spectator, that permit to choose alternative beliefs, more adequate to what presented until that point of the telling. I wish to introduce an inference rule containing less strong conditions. We can replace $bel(Spx, sameR(RelPro2, RelPro1))$ (RelPro1 and

The rule 5.7.2 is known as the principle of the identity of indiscernible - if two objects are identical the they are the same proprieties.

The rule 5.7.1 is not the one that the spectator applies. For to establish that x e y are identical, it is necessary to activate a process that checks that all the properties of x are also property of y. Instead, the spectator infers on the identity of two characters starting by a sharing of few properties, sometimes also through only one specific property, common to two characters.

RelPro2 are the same properties) and $bel(Spx, sameV(V2, V1))$ (RelPro1 and RelPro2 have the same values), respectively, with:

$$\begin{array}{ll} bel(Spx, isLike(RelPro2, RelPro1)) & \text{\%RelPro1 and RelPro2 are similar} \\ bel(Spx, isLike(V2, V1)) & \text{\%V1 and V2 have equivalent values.} \end{array} \tag{5.7.5}$$

In this way the 5.7.3 becomes: Spx believes that in E2 P1 and P2 are the same characters if Spx believes that: P1 takes part to E1; P2 takes part to E2; E1 the property RelPro1 of P1 is valid; in E2 the property RelPro2 of P2 is valid; RelPro1 and RelPro2 are similar; V1 and V2 have equivalent values; and the condition $spr(Tx, Spx, Prop1, V1)$ is valid. Formally:

$$\begin{array}{l} mev(Tx, bel(Spx, sameP(P2, P1))) \leftarrow \\ \quad mev(Tx, bel(Spx, who(E1, P1))), \\ \quad mev(Tx, bel(Spx, who(E2, P2))), \\ \quad mev(Tx, bel(Spx, propEv(E1, prop(Propr1, P1, V1)))), \\ \quad mev(Tx, bel(Spx, propEv(E2, prop(Propr2, P2, V2)))), \\ \quad mev(Tx, bel(Spx, isLike(Propr1, Propr2))), \\ \quad mev(Tx, bel(Spx, isLike(V2, V1))), \\ \quad spr(Tx, Spx, Prop1, V1). \end{array} \tag{5.7.6}$$

We can define the condition $spr(Tx, Spx, Prop1, V1)$ in following way:

$$\begin{array}{l} spr(Tx, Spx, Prop1, V1) \leftarrow \\ \quad mev(Tx, bel(Spx, highSpec(Prop1))), \\ \quad mev(Tx, bel(Spx, highSpec(V1))). \end{array} \tag{5.7.7}$$

For representing spectator's beliefs about properties and relative values having high specificity, I use the notations $mev(Tx, bel(Spx, highSpec(Prop)))$ and $mev(Tx, bel(Spx, highSpec(V1)))$. For example some characters's properties as "having scar on the face", or "to speak with a particular accent". Most of the time the spectator's weak inferences of the kind 5.7.3 or 5.7.6 are confirmed by events that happen subsequently in the story. Just thinking to some events in the movie *21 grams* – in a sequence is presented a man in the hospital – very ill with oxygen that helps him in breathing, and in another following, a woman refers to a person to have an husband near the death. In this case, the man's property is very singular, in the small dominion of knowledge of the story, the spectator with a very little effort (without analyzing many other suppositions) infers that the man in the hospital is the woman's hus-

- Temporal Anchoring and Disanchoring
  - Temporal deixis for evocation
    - Deixis for repetition of events D1 —
    - Repetition of events through media reporting an event happened D2 —
    - Deixis through causality between two events D3 —
    - Deixis through causal prediction of an event D4 —
    - Deixis through anticipation of the effect D5 —
    - Deixis through anticipation of the event through a voice utterance D6 —
    - Deixis through posticipation of the event through a voice utterance D7 —
    - To promise of executing an action(event) and remain committed D8 —
    - Deixis through events temporally rigid D9 —
  - Flashbacks and flashforwards
    - Narrative Flashbacks and Flashforwards
      - Flashback between events visually contiguous F1 —
      - Narrative flashbacks with delay in the recognition of the flashback F2 —
      - Narrative flashforwards F3 —
    - Flashbacks and Flashforwards of thought
      - Flashbacks of memories F4 —
      - Flashforwards of thought through projection in future of character. F5 —
    - Flashbacks and Flashforwards of words (caption or extradiegetic voice with)
      - chronological time and the enunciation of an event F6 —
      - temporal adverbial and the enunciation of an event F7 —
      - only a chronological diegetic time F8 —
      - only temporal relationship F9 —
  - Flashback and flashforwards, through variation black and white - color
    - Color used for events to the present - black and white to the past F10 —
    - Black and white used events to the present - color to the past F11 —
  - Ellipsis
    - Explicit Ellipsis E1 —
    - Implicit Ellipsis E2 —
    - Hypotetical Ellipsis E3 —
  - Relations between scenes and spaces
    - Diegetic sequentiality by default R1 —
    - Temporally overlapped events - only act of vision R2 —
    - Simultaneous events R3 —
    - Events intersecting through sharing of participants R4 —
    - Causality and contiguity among events R5 —
  - Non temporal deixis
    - Characters with the same name N1 —
    - Repetition of events (general scheme) N2 —
    - Repetition of events for irrepeatability of the action N3 —
    - Repetition of events for specificity of the action N4 —
    - The repetition of events imply the identity of the events N5 —
    - Deixis through specific properties of a character N6 —
  - Counterfactualities among events
    - Multiple anchoring M1

Figure 5.7.1: Temporal Anchoring and Disanchoring

band (In the chapter 7 I will report a formal representation of this inference cognitive rule).

5.8 TEMPORAL ANCHORING AND DISANCHORING

In the closing of this chapter, I report in figure 5.8 a summary of the anchoring and of other narrative figures creating a break (disanchoring) of the story axis.

Part IV

Characters’ point of view

6 COGNITIVE STATES OF CHARACTERS

A cognitive state of a character constitutes a particular spectator's belief, who for some motivation linked to what he has observed in the scene, attributes a desire (objective or aim), a belief, or an intention to a character Px of the story. I will take into account as argument of these three mental attitudes, an event Ex – for this reason in my representation of the spectator's mental state we have:

- $bel(Spx, goal(Px, Ex))$ the spectator believes that the character Px has the goal or desires that the event Ex happens;
- $bel(Spx, bel(Px, Ex))$ the spectator believes that the character Px believes that the event Ex happens;
- $bel(Spx, int(Px, Ex))$ the spectator believes the character Px has the intention to make happen the event Ex (through its own direct action or through other characters).

In the believes of type $bel(Spx, bel(Px, Ex))$, Ex is not event that the spectator Spx believes has *really* happened in the story. For this reason if a spectator Spx believes that an event Ex has happened and on the contrary a character Px doesn't believe it, then Spx has different possibilities. Spx can label as ingenuous Px; he can feel compassion of Px because he hadn't the ability to understand that Ex had happened; he can believe Px a liar (if Px affirms that Ex has happened), he can label the story as incongruous, or contradictory. I will see later in the chapter dedicated to counterfactual stories, and in those regarding the open stories, that the spectator is able to understand the differences among his direct beliefs and a character's beliefs without believing that there is an incongruity or conflict in the story. If a spectator sees a character Pa dying in a sequence, and subsequently in the narration (without that occurs a return back in the story) he sees the same person alive, then he will perceive an incongruity in the story, as a contradiction existing among his beliefs. In contrast if after Pa's death (always that there isn't a return back in story) a character Px believes that the person Pa is alive, then this won't constitute for the spectator an incongruity, because the belief belongs to Px and does't belong to him – the spectator tries always to distinguish his point of view, from that of the characters.

Regarding the observations until now made, there is the necessity to insert in my representation distinguished mental axes for each character, in such way we can consider characters' cognitive states, as contexts separated of analysis[1] inside of which to operate specific analysis (see figure 6.0.1). I have represented the characters' beliefs through diagrams TN-TS-TB (see figure 6.0.2).

I assume that there aren't inconsistences inside every mental context of a character – but that could exist counter positions between spectator's and character's beliefs or also among different characters. We remember that the mental state of a character is always individuated by spectator's *eye* – and it is always only the spectator to attribuite incongruities to the mental state of a character – obviously this process of attribution derives from what the spectator sees in the diegesis about the behaviour of the characters themselves (in this chapter I will discuss in detail on ocularisation concept).

The spectator, besides considering different states of characters' beliefs, could attribuire to some characters a different belief on the duration of the events. In the example in figure 6.0.2 it was given only the temporal distance between the initial instant of two events $\mathsf{E1}$ and $\mathsf{E2}$, to give the idea that the beliefs of temporal duration are different – the example considers that the spectator Spx and the character $\mathsf{P1}$ have the same belief of temporal duration between the instants considered:

$$bel(Spx, sameDur([Tn, Tm], [Tn1, Tm1]))$$

1 The model until here described it is based on the central idea of a formal theory denominated Belief Contexts [Ghidini2001], [Serafini2002]. Belief Contexts is a formalism for representing the mental attitudes (Beliefs, Intentions, Goals) of the rational agents. In the Belief Contexts paradigma, every agent can be represented by one or more mental internal context (beliefs, goals, intentions) in a way independent from other mental contexts. In this theory the interaction among contexts represent the effect of the communication among the agents, in this way a community of agents evolves in time through the revision of their mental state. I will return to this matter in chapter 8 to model the courses of events.

While the character Pb has a temporal belief of shorter duration:

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{lessDur}([\mathsf{Tn2}, \mathsf{Tm2}], [\mathsf{Tn}, \mathsf{Tm}]))$$

The given representation can model for example a time travel of a character – if the latter has travelled to the speed of light he comes back on the earth (according to the speaking instance and to the spectator) younger then when he has gone, then the spectator can record a minor time regarding the life of the character who has travelled[2]. Other examples of different beliefs of temporal duration are present in movies in which there are partial time slices, where the time referring to a character goes on, while for others it stops. An example of a complex temporal perception of the characters is in *Groundhog Day*, in which the temporal duration of a character's day (Phil the protagonist – Bill Murray) it expands[3] respecting to the diegetic time of other characters.

The spectator acquires beliefs on the character's inner cognitive states through:

- Characters' speaking (the act of uttering a sentence);
- Characters' seeing (through particular ocularizations);
- Characters' remembrance and dream;
- Characters' behaviour

6.1 WORDS - CHARACTER'S SPEAKING

In chapter 4.5.3 I have already discussed about the effects of the extradiegetic voice on spectator's temporal belief. In the paragraphs 5.5.1 and 5.5.2 I have introduced a couple of cognitive states, composed of: an expectation – a cognitive hook – (when an event has announced that has happened or will happen);

2 A person back to being young as consequence of fact that has travelled in time, is one inference that most spectators lovers of science fiction movie have. It is known however that laws of physics don't give the same prevision (see [Resnik1968])

3 The cognitive time of the characters has been labeled in literature as "personal time" see the works by [David1976], and [Pezzotta2011]. However in a cognitive approach, I have to keep into account that the duration of personal time of a character is an entity believed (attributed) by the spectator (it is a subject of one of his belief). This is why the spectator attributes always the same diegetic duration to Phil, for every day that he lived – placing such temporal intervals on courses of different events (I will discuss in detail the notion of personal time in the section 8.3.).

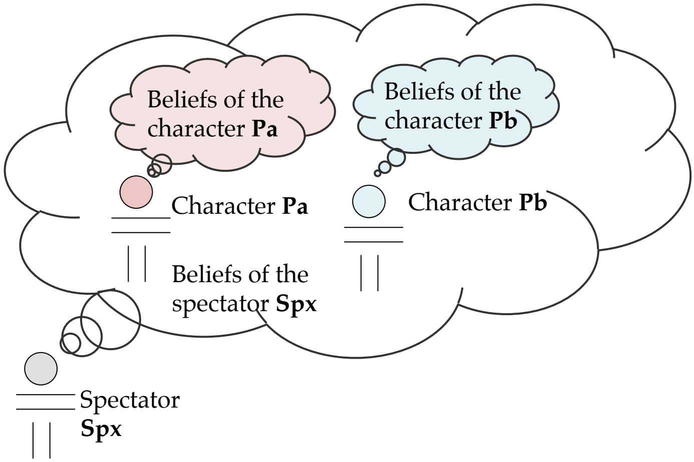


Figure 6.0.1: Spectator's beliefs about the characters' beliefs

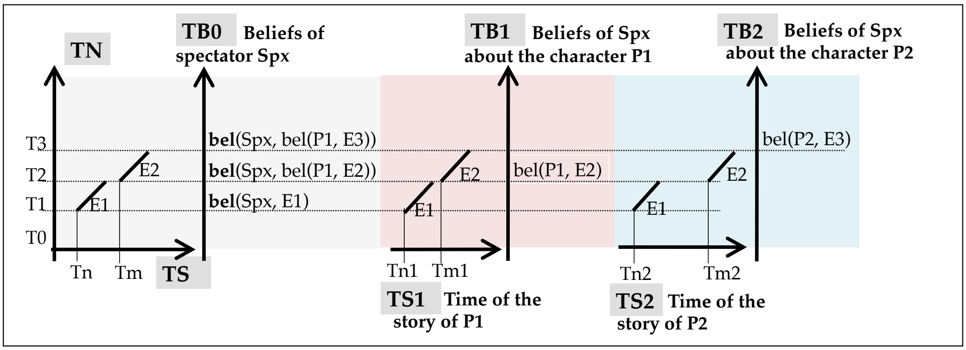


Figure 6.0.2: The spectator's beliefs about the beliefs of the characters represented by TN-TS-TB diagrams

and the satisfaction of the expectation (when the event is shown in the diegesis) – these two cognitive states permit to the spectator to perform a temporal anchoring on the story axis.

In this section, I report a series of rules constituting a filter to assume as true what a character says[4]. The cognitive rules are represented in the scheme in

4 There are many events of the film stories where the viewer does not believe what a character says. It would have been interesting to explore all these cases, but this would have brought us to make a long digression from the argument that I are dealing with. For this reason I have formalized some cases only, that nevertheless I believe are sufficient for analyzing complex stories having, for example, a complexity as Rashomon.

	i1 ←	**b1**,	**c1**.
Default assumption	Spx believes that E2 happens	Spx believes that Px say that E2 happens	Spx believes that does not exist an event Ey where E2 Xor Ey
	i2 ←	**b1**,	**c2**.
Direct assumption	Spx believes that E2 does not happen	Spx believes that Px says that E2 happens	Spx believes that exists an event Ex where Ex Xor E2
	i3 ←	**b1**,	**c3**.
Bad faith	Spx believes that Px says a lie	Spx believes that Px says that E2 happens	c2 is true and Spx believes that Px does not believe that E2 happens
	i4 ←	**b1**,	**c4**.
Good faith	Spx believes that Px believes that is confused or he was deceived	Spx believes that Px says that E2 happens	c2 is true and Spx believes that Px believes that E2 happens
	i5 ←	**b1**,	**c5**.
Liar forever	Spx believes that Px at time Td2 > Td1 says lies	Spx believes that Px says that E2 happens	Spx believes that Px at time Td1 says a lie

(6.1.1)

Figure 6.1.1: What a character says

figure 6.1.1, where I anticipate the rules in an informal manner, I will formally define the conditions b1, c1, c2, c3, c4 and c5 and the inferences i2, i3, i4, i5.

The **rule i1 ← b1, c1** is frequently used by the spectator, and lead to assume the belief that a determined event $E2$, if referred happening by a character, has really happened in the story. A kind of belief assumption for default, that requires that the condition $c1$ is true, that is that the spectator hasn't, in his cognitive state, no belief relating to another event Ey, where Ey and $E2$ are mutually exclusive ($xor(E2, Ey)$). I report the definitions for $b1$, $c1$ and $i1$. The first ($b1$) regards the act of saying of a character Px, I represent through the following logic conjunction:

$$\begin{array}{ll} & mev(Tx, bel(Spx, say(Px, E2))) \leftarrow \\ 1 & mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))), \\ 2 & mev(Tx, bel(Spx, who(E1, Px, Pa)), \\ 3 & mev(Tx, bel(Spx, what(E1, say(Px, Pa, when(E2, before([Td1, Td2])))))), \\ 4 & mev(Tx, bel(Spx, what(E1, say(Px, Pa, what(E2, Az))))), \\ 5 & mev(Tx, bel(Spx, what(E1, say(Px, Pa, who(E2, P1; P2; ..; Pn))))). \end{array} \tag{6.1.2}$$

The condition 1 asserts that a spectator Spx believes that an event $E1$ happens on the interval $[Td1, Td2]$; 2 that Spx believes that the characters Px and Pa participate to the event $E1$. The expressions 3, 4 and 5 describe the action (what) of the event $E1$, that is a character's action in which Px tells Pa: 3 represents that Px says to Pa that an event $E2$ has happened before a certain temporal interval ($when(E2, before([Td1, Td2]))$); 4 asserts that the action of the event $E2$ is Az; and 5 asserts that the participants of $E2$ are $P1; P2; ..; Pn$. The condition $c1$ can be represented in the following way:

$$\begin{array}{l} mev(Tx, bel(Spx, no\_xor(Ey, E2))) \leftarrow \\ \quad not\ mev(Tx, bel(Spx, xor(Ey, E2))), \\ \quad diegeticEvent(Ey). \end{array} \tag{6.1.3}$$

The conclusion $i1$ has the following definition:

$$\begin{array}{l} mev(Tx, bel(Spx, E2)) \leftarrow \\ \quad mev(Tx, bel(Spx, say(Px, E2))), \\ \quad mev(Tx, bel(Spx, not\_xor(Ey, E2))), \\ \quad participant(Px), \ \ diegeticEvent(Ey). \end{array} \tag{6.1.4}$$

From a methodological point of view, it is important to emphasize that my model is constructed with a low, (or almost null) resistance of the spectator to the cognitive change. I must add that, in the same model, there are some filters of no acceptability that the spectator activates when there are conflicts in the knowledge he is acquiring (as I will show later in this book, this in turn will activates some processes of knowledge revision).

Rule i2 ← b1, c2. A particular case of conflict occurs when the spectator for direct vision (not mediated by the telling of some character) believes that a certain event Ex has happened, and this event is not compatible with an event $\mathit{E2}$ reported as happened by a character. We are in the case $i2 \leftarrow b1, c2$ where $c2$ is represented through the following inference: Spx believes that an event Ex happens and is in conflict with $\mathit{E2}$ ($\mathit{xor}(\mathit{Ex}, \mathit{E2})$).

$$
\begin{aligned}
&\mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{conflict}(\mathit{Ex}, \mathit{E2}))) \;\leftarrow \\
&\quad \mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{Ex})), \\
&\quad \mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{E2})), \\
&\quad \mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{xor}(\mathit{Ex}, \mathit{E2}))).
\end{aligned}
\tag{6.1.5}
$$

Rule i3 ← b1, c3. If the condition $\mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{xor}(\mathit{Ex}, \mathit{E2})))$ is true, the spectator doesn't add any knowledge to what he knows, keeping into account that the knowledge he has directly acquired by the vision of the events *is more truthful* than the one reported by a character Px – he just has to decide if the character Px, that has reported $\mathit{E2}$, has said (intentionally) a lie, or not. However, which elements has the spectator to choose between the two options? Sometimes, he has no elements, but if he owns them – these are evident. For example if Px has reported a version different from the one of another character, or also in the case in which, the declaring that Ex has happened is a reason of innocence for some crime committed by Px himself, and so on. There are many filmic situations that can lead the spectator to believe that Px didn't believe in what he affirmed, and then Px has said a lie. These situations determine the belief $\mathit{not}\ \mathit{bel}(\mathit{Spx}, \mathit{bel}(\mathit{Px}, \mathit{E2}))$, that I assume as condition in the my model:

$$
\begin{aligned}
&\mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{what}(\mathit{E3}, \mathit{lie}(\mathit{Px}, \mathit{E2})))) \;\leftarrow \\
&\quad \mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{conflict}(\mathit{Ex}, \mathit{E2}))), \\
&\quad \mathit{not}\ \mathit{mev}(\mathit{Tx}, \mathit{bel}(\mathit{Spx}, \mathit{bel}(\mathit{Px}, \mathit{E2}))), \\
&\quad \mathit{diegeticEvent}(\mathit{E3}).
\end{aligned}
\tag{6.1.6}
$$

Rule i4 $\leftarrow$ b1, c4. The spectator Spx believes that Px is confused or he was deceived if Spx believes that there is a conflict between two events Ex and Ey (as described in 6.1.5), and believes that Px believes $E2$ has happened:

$$\begin{aligned}&mev(Tx, bel(Spx, confusDeceiv(Px))) \ \leftarrow\\ &\ mev(Tx, bel(Spx, conflict(Ex, E2))),\\ &\ mev(Tx, bel(Spx, Ex)),\\ &\ mev(Tx, bel(Spx, bel(Px, E2))).\end{aligned} \tag{6.1.7}$$

Rule i5 $\leftarrow$ b1, c5. The spectator Spx believes that Px at a time after the interval $[Td1, Td2]$ ($after([Td1, Td2])$) says a lie about an event Eb, if Spx believes that Px on $[Td1, Td2]$ has said a lie about an event Ea. Formally:

$$\begin{aligned}&mev(Tx, bel(Spx, what(Ey, lie(Px, Eb))))) \ \leftarrow\\ &\ mev(Tx, bel(Spx, what(Ex, lie(Px, Ea))))),\\ &\ mev(Tx, bel(Spx, when(Ex, on([Td1, Td2])))),\\ &\ mev(Tx, bel(Spx, when(Ey, after([Td1, Td2])))),\\ &\ mev(Tx, bel(Spx, what(Ey, say(Px, Eb)))), \quad \text{\% Px reports the event Eb}\\ &\ not\ cx(Tx, Spx, Eb).\end{aligned} \tag{6.1.8}$$

The rule 6.1.8 takes into account that not all events reported by the character (liar) Px are false. For this reason I have inserted a filter that attempts to evaluate specifically what the character Px has said. It is obvious that we can only report some particular cases. A pretty strong condition is to rule out that the event Eb, reported by Px, is believed to be true (for some reason) by the same spectator:

$$cx(Tx, Spx, Eb) \leftarrow mev(Tx, bel(Spx, Eb)).$$

Spx may for example believe that Eb happens because it was reported by a character Py other than Px (the liar) that Spx believes is honest:

$$\begin{aligned}&mev(Tx, bel(Spx, Eb)) \leftarrow\\ &\ mev(Tx, bel(Spx, say(Py, Eb))),\\ &\ mev(Tx, propTd(Tdx, prop(honest, Py, yes)),\\ &\ diegeticTime(Tdx).\end{aligned} \tag{6.1.9}$$

CHARACTERS TELLING LIE — SPECTATOR'S ASSUMPTIONS AND REVISIONS In the scheme in figure 6.1.1 I have supposed that, in the deductive path $i2$, $b1$, $c2$, the conditions $c2$ and $i2$ are both present at the time Tx. If the condition $c2$ is acquired later in the narration at time $Ty>Tx$, it happens that the spectator firstly has to perform an assumption of the kind $i1$, and successively a revision of what he has acquired (elimination of $i1$). The expressions $i1$ and $i2$ are then valid, the spectator's mental state is the following:

$$\begin{aligned}&mev(Tx, bel(Spx, say(Px, E2)))\\&mev(Tx, bel(Spx, E2)))\end{aligned} \tag{6.1.10}$$

The mental state determined by the telling ($b1$) of a character Px, and by the believing that it is true the content of this telling ($E2$), can be denominated belief based on the telling of Px.

If this mental state is true, and the condition $c2$ is true (the spectator acquires know-ledges in conflict with the telling Px), then it is necessary to remove the assumption $i1$, that is, that the event $E2$ has happened (in the cognitive space of the spectator is always the believing that Px has told that $E1$ happened):

$$\begin{aligned}&mev(Tx, remBel(bel(Spx, E2))) \leftarrow\\&\quad mev(Tx, bel(Spx, say(Px, E2))),\\&\quad mev(Tx, bel(Spx, E2))),\\&\quad mev(Tx, bel(Spx, conflict(Ex, E2))),\\&\quad diegeticEvent(Ex).\end{aligned} \tag{6.1.11}$$

The spectator arrives to the conclusions of 6.1.11 both that the character Px is in good faith, or in bad faith. In the next paragraph I will show that the conflict arising from different stories of characters, leads to a revision of the beliefs acquired by the spectator.

The spectator's belief that the character Px told, until that point in the telling, the truth about E2, constitutes a prerequisite of credibility (or at least of *not to have suspicions*) to Px. It is clear that when a belief is created, after that Px said a lie, the spectator is obliged to investigate and, if it is the case, eliminate most part (all?) of beliefs acquired after the character's affirmations who has told the lie.

I will not address this problem by a formal and computational point of view[5]. In qualitative terms, we just say that a process of spectator's revision exists. It occurs at the end of each vision act, when at starting from all the acquired knowledge in his cognitive space, included what a character has said, he chooses which beliefs maintain, and which not.

Obviously, if occurs a character's lie in the story, other characters also forced to make revisions in their the mental state. Such changes are recorded as new beliefs of the spectator.

As example, I wish quoting the famous scene of the detective Samuel Gerard (Tommy Lee Jones) in the movie *The Fugitive*[6], when Gerard discovers that a person (Mr. Kendal), a friend and a colleague of the protagonist Richard Kimble (Harrison Ford), has told a lie to the police. Gerard calls to a collaborator saying, "the doctor Kendal has told us a lie". He reports the fact, as an implicit order to investigate about Kendal – and he does it without referring what is the particular lie. Evidently according to Gerard, to investigate and discover what a person knows, it is sufficient that there are not lies in what the person says. Some stories of the movies, in this way, provide the empirical rules of the adjournment of the spectator's knowledge: who tells a lie, tells also other lies, and as we are not always able to discriminate among the things are referred to us, what is true from what is false, then a person who has told once a lie is not credible – he always says lies. The "liar forever" rule does not address the problem of the beliefs revision about events that have already been acquired by the spectator when he discovers that the person who tells is a liar. If a "false truth", reported by a liar character Px, is propagated through other inferences, it is not always possible to trace everything that Px has affirmed,

5 In a perspective of building a computational model, the issue it is very complex – it is equivalent to find again all the spectator's beliefs deriving from false assertions of a determined character. This problem is well known to theoretical computer scientists and is classified as a hard computation problem. I believe, however, that there are considerable differences between the inferential computational methods of a computer and those of the human spectator. In this case, in all probability, the character in the scene as well as the spectator will be in possession of some heuristic method that will allow him to evade the problem of "hard computationality" by applying partial elimination meta-rules on the claims made by the lying character.

6 *The Fugitive* is a 1993 movie directed by Andrew Davis and interpreted by Harrison Ford and Tommy Lee Jones. The latter won the oscar as best supporting actor.

togheter to the associated logical consequences, for performing the necessary revisions.

However, although the problem is known as computationally hard, I believe that in many cases it is possible to define specific inferences in order to eliminate the conflicts arising from the false truths reported by the characters in a story.

In the following paragraph I will discuss the case of *Rashomon* where the viewer is forced to make a revision even when no beliefs on the identity of the liar have been created, but there are conflicts between the events reported by different characters.

RASHOMON - WHEN THE IMAGES LIE. Rashomon has made raising various discussions – the movie appeared in the 50s when cinema theories hadn't the critical and analysis instruments existing now. The issue was raised about the question if a narrative voice could say the false or not. It seems that the attentive analysis by U. Volli[7] emerges among the others. First of all about the observation he does, regarding the narrative voices present in *Rashomon* that are diegetic (belong to characters of the story) – as such, among their prerogative – they can lie. U. Volli's analysis reaches the conclusion that it is not possible, at the end of all the versions given by the characters, to establish which the truth is. I agree with most of this analysis, also if I believe that I have to take into account the dynamic aspect, that is, the cognitive changes of the spectator, as the different characters' versions are given in the story.

After the first telling of the story, when the first character P1 tells, the spectator accepts in good faith all that P1 refers – the rule is the 6.1.1 given in the previous paragraph, instantiated to the values of the telling of the first character. When in the following of the story is reported the telling of the second character P2, the spectator finds some conflicts. There are some events Ex and Ey referred respectively by the characters P1 and P2, that result incompatible – $\mathsf{bel(Spx, xor(Ex, Ey))}$ (or it is true that Ex has happened or it is true that the other event Ey has happened). The spectator is forced so to remove the beliefs regarding the telling of P1. The analysis done suggests to introduce another cognitive rule of revision, asserting that it is necessary to remove some

7 See the observations by U. Volli in ”Quando le immagini mentono” reported in the extra content in the DVD of the Italian movie.

Figure 6.1.2: Rashomon

beliefs acquired from the characters' telling, when there are beliefs that are in contrast among them:

$$\begin{array}{ll} 6 & \mathit{mev}(Tx, \mathit{remBel}(\mathit{bel}(Spx, Ex))) \leftarrow \\ 1 & \quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{say}(P1, Ex))), \\ 2 & \quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{no\_xor}(Ex, Ez))), \\ 3 & \quad \mathit{mev}(Tx, \mathit{bel}(Spx, Ex)), \\ 4 & \quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{say}(P2, Ey))), \\ 5 & \quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{xor}(Ex, Ey))). \end{array} \tag{6.1.12}$$

The (1) represents the telling of $P1$ that the event Ex has happened; the (2) that the spectator hasn't beliefs on events (Ez) in conflict with Ex; the (3) is the assumption of belief of the spectator at the declaration (1) of $P1$; in (4) an another character $P2$ asserts that Ey has happened; the (5) affirms that the spectator believes that two events Ex and Ey are in conflict. In the end, the (6) represents the elimination of the assumption made by the spectator regarding the fact that the event Ex has happened. I point out that the beliefs (1), (2), (4) and (5) haven't been removed – and that after the first telling there isn't anymore a conflict in the spectator, also if in the end of the telling the spectator goes on not to have direct beliefs regarding the facts of the story, also if preserving the beliefs that all the characters have reported stories that present conflicts among themselves. There is also another problem (underlined also in U. Volli's analysis) that every character blames himself for having killed the samurai – this constitutes a meta knowledge that confounds the spectator even more, as it is valid the rule that a person who accuses himself of a serious event, is generally a person that says the truth. In conclusion the spectator, also if passes through revision states of his beliefs that don't contain contradictions, can't accept any version of the story, as the characters' tales are contrasting. I report in a synthetic form, the conclusions emerging from the analysis of Rashomon's movie:

1. There isn't a direct acquisition by the spectator of the story facts by – all the hypothesis about the events sequence of the killing, arise from what characters tell;
2. At the end of the movie some conflicts exist among the versions given by various characters – there are couple of events Ex and Ey that are mutually exclusive: $bel(Spx, Ex\ Xor\ Ey)$; All the versions told internally are logically consistent, and by this point of view, the spectator considers them equivalent;
3. The spectator applies only after the first tale the rule of assumption for default 6.1.1, after the telling of the other protagonists, for the inference 6.1.12, he doesn't do any other assumption[8];
4. The spectator cannot do any valuation of character's good faith reporting different story versions of the killing – all are potentially believed in good faith, as all auto accuses themselves – maybe someone has told the truth, but the spectator doesn't know it. In the telling there aren't other evidences that can permit the spectator to make other hypothesis leading to the resolution of the problem;

8 Formally to keep into account also of the following tellings, I propose to add a restriction to the filter $c1(Spx, E2, Px)$ by imposing that besides don't have direct knowledge that has involved previously Px, also to don't have indirect knowledge, that is the telling dealing with Px. It is reader's task the writing of this rule.

5. The spectator has the same quantity of knowledge of the narrating instance regarding the events happened in the story (see in 6.5 the discussion on focalization), knowledge that for long tracts is the same of the one of the jury.

Later I report some analysis on the same arguments of this paragraph, for the movie the *Usual suspects* in which the extradiegetic voice, differently by what happens in *Rashomon*, is denied by the story events and the spectator knows who told the lie.

6.2 THE OCULARIZATION IN A COGNITIVE PROSPECTIVE

Among the mechanisms that generate beliefs in the spectator, regarding what the characters *see*, and consequently, believe – the ocularization plays a relevant role. The ocularization in general is defined as "the relation existing between what the camera (or the narrating instance) shows and what we presume that the character sees"[9] Through some steps, I make a rewriting of the ocularization concept, in terms of causal relation ”⇒” between a cognitive state of the story author (scriptwriter, director and so on) and the spectator. Firstly I make explicit the locution "it presume,..,sees", for which I have to suppose that ”who presumes" is the spectator. In these terms:
the ocularization is a relation existing between what the camera (or the narrating instance) shows and what the spectator believes that the character sees”. It is evident that behind the displaying of the camera (or narrating instance) there is a mental attitude of the author which consists ”of having intention that the viewer believes what the character sees”. In rewriting the previous definition of ocularization it results that:
the ocularization is a relation existing between ”what” the spectator believes

9 The definition given is by G. Rondolino and D. Tomasi in [Rondolino2011] pag. 43, while the introduction of the concept of ocularization is due to Francois [Jost1987].

the character sees and "what" the direction/author intends to make believe (through what the camera shows):

$$mev(Tx, bel(Spx, what(Ex, see(Px, \beta)))) \leftarrow \\ mev(Tx, int(Aut, do(Aut, bel(Spx, \alpha)))$$

As it is valid (see forward in this chapter) the inference: the spectator Spx believes that Px believes that β happens if Spx believes that Px sees the event β.

$$mev(Tx, bel(Spx, bel(Px, \beta))) \leftarrow \\ mev(Tx, bel(Spx, what(Ex, see(Px, \beta)))).$$

the causal cognitive relation for the ocularization becomes:

$$mev(Tx, bel(Spx, bel(Px, \beta))) \leftarrow \\ mev(Tx, int(Aut, do(Aut, bel(Spx, \alpha)))) \tag{6.2.1}$$

Definitively, the ocularization in a cognitivist optic can be defined as:
the relation establishing between what the spectator believes the character believes and what the author/director intends to make believe, (through the showing of the camera or the narrating instance). At this point is evident that from a cognitive point of view, the ocularization – however it is staged – is a dispositive regulating the attribution of the beliefs to the story characters. According to the latter assumption, in this chapter I will execute an analysis, in order to establish a taxonomy of ocularizations.

Particular dispositions of the camera, leading not to attribute any beliefs to a story character, are also considered them a type of ocularization (zero ocularization). It is what the spectator sees or perceives in a direct way from the scene, without any mediation. In effect, this direct modality of belief acquisitions is present every time that in the scene diegetic events are shown, and starting from latter, spectator's beliefs ($bel(Spx, Ex)$) are created. I have named such correspondence (paragraph 2.5) principle of perception-belief (act of vision).

Each internal ocularization of a character (a character's belief) is constructed through a preliminary zero ocularization – the spectator firstly must be able to

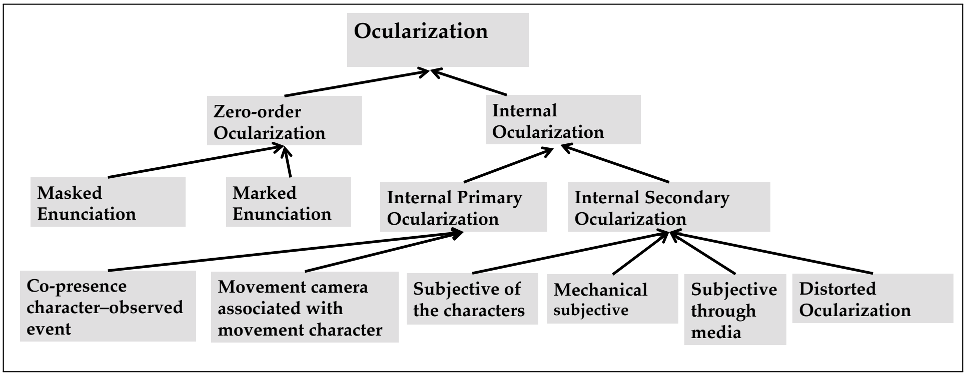


Figure 6.2.1: A taxonomy of the ocularizations

observe a character Px in the story that sees an event Ex (zero ocularization), then he infers that Px believes that Ex has happened (internal ocularization).

In [Rondolino2011] are reported different categories of ocularizations as synthesis of the work by Jost. Starting from the work proposed by such authors, I introduce new categories and propose a taxonomy of ocularizations, in cognitive terms. In the scheme of figure 6.2.1 I report the complete taxonomy I will take as guide for the analysis that I will make in the next paragraphs.

6.2.1 External ocularizations (zero-order ocularizations)

Masked and marked ocularizations are considered as ocularizations of zero order.

MASKED OCULARIZATIONS. In this ocularization typology, there is a very discrete presence of the camera, as it isn't perceived, or even forgetting, to the spectator he is watching a movie, filmed by a camera. In this case the events shown in the images appear to the spectator without any mediation, and they are those he directly inserts among his beliefs as events happened. These relations between narrating instance and beliefs on the story events can be modelled as referred by the principle of perception-belief.

MARKED OCULARIZATIONS. In this case of ocularization we feel the presence of the narrating instance. It is the case in which the spectator per-

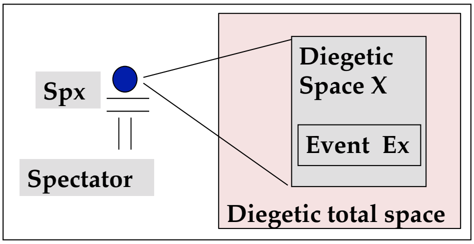


Figure 6.2.2: Masked ocularization

ceives a camera M (also if he doesn't see it), that becomes not only an *independent eye*, but imposes to the spectator its point of view: it selects for him, a part of diegetic space on which focus the attention. In this case the spectator does not link a character to the (perceived) movement of the camera although he perceives the presence of a filming camera.

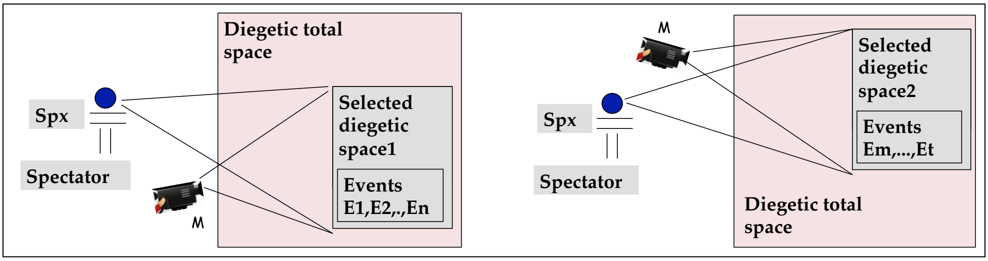


Figure 6.2.3: Marked ocularization

Travelling movements proposed in the contemporary cinema belong to this category – for example the opening sequence *Chocolat* [Chocolat], or in the opening of *Hugo Cabret* [HugoCabret], or in *Spy Game* [SpyGame], with the original vorticity of the movement camera turning around to two characters Nathan Muir (Robert Redford), and Tom Bishop (Brad Pitt) on the roof of a building in a sequence in which they animatedly speak.

6.2.2 Internal ocularizations

For internal ocularizations we are in the situation in which the spectator *sees*, through the eyes of a character Px, an event Ex. In these kinds of ocularization two basic inferences are valid: Spx believes Ey happens if Spx believes that: Ex happens, Px participates in the event Ex, and Px sees Ey.

$$\begin{array}{ll} 1 & mev(Tx, bel(Spx, Ey)) \ \leftarrow \\ 3 & \ \ mev(Tx, bel(Spx, Ex)), \\ 4 & \ \ mev(Tx, bel(Spx, who(Ex, Px))), \\ 5 & \ \ mev(Tx, bel(Spx, what(Ex, see(Px, Ey)))). \end{array} \tag{6.2.2}$$

Spx believes that Px believes Ey happens if Spx believes that: Ex happens, Px participates in the event Ex, and Px sees Ey.

$$\begin{array}{ll} 2 & mev(Tx, bel(Spx, bel(Px, Ey))) \ \leftarrow \\ 3 & \ \ mev(Tx, bel(Spx, Ex)), \\ 4 & \ \ mev(Tx, bel(Spx, who(Ex, Px))), \\ 5 & \ \ mev(Tx, bel(Spx, what(Ex, see(Px, Ey)))). \end{array} \tag{6.2.3}$$

There are different modalities through which the spectator acquires the belief 5, but whatever is the director's strategy, the inferences 6.2.2 and 6.2.3 are always activated. From way in which the conditions 3, 4 and 5 are created, I distinguish two main ocularization categories, known in cinematographic theory as primary internal ocularizations and secondary internal ocularizations.

SECONDARY INTERNAL OCULARIZATIONS. The secondary internal ocularization happens when the events have in them traces of someone looking[10].

CO-PRESENCE EVENT AND CHARACTER WHO SEES THE EVENT. The classic situation for this ocularization kind is the one in which spectator Spx, does not matter what is his motivation, and he believes that a character Px observes an event Ex (or more events E_i) – for example Spx sees from behind Px looking at Ex (sees figure 6.2.4), or sees Px's shadow or part of Px's body – in these cases Spx also sees Ex, and for the non complete showing of Px seeing Ex, the Px's vision is inferred by the spectator. A very frequent case of this kind ocularization is the one related to a character Px seen from behind by the spectator. The relative models are constructed starting by an

10 In [Rondolino2011] p. 44.

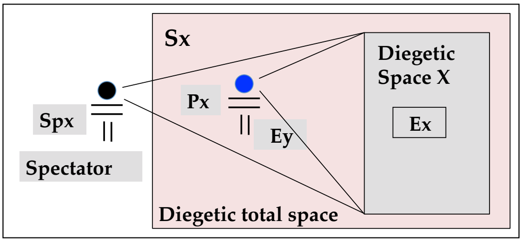


Figure 6.2.4: Copresence event and character who sees the event

only act of vision $visAct([T1, T2], Spx, [Td1, Td2], [Ex, Ey])$ leading to the acquisition of the beliefs $bel(Spx, Ex)$ and $bel(Spx, Ey)$ – where Ey is the event showing the watching of Px. A specific staging of Ey is represented by:

mev(Tx, bel(Spx,what(Ey, see(Px, Ex))))

where the spectator believes that Px sees Ex. The acquisition of the latter belief allows the spectator to apply the 6.2.2, leading to the consequence that Spx believes that Px believes that Ey has happened, that is[11]:

$$bel(Spx, bel(Px, Ey))$$

THE MOVEMENT OF THE CAMERA IS ASSOCIATED TO THE MOVEMENT OF THE CHARACTER. In this case it is not requested that the character Px is present in the diegesis (see figure 6.2.5). Among the elevated number of staging techniques of these figures of telling working on the camera position, there is that in which an extradiegetic voice (homodiegetic or eterodiegetic) generates an internal ocularization through a character that see an event showed in the diegesis. In this case a basic condition for the internal ocularization, is that in which the spectator believes that a character Px sees Ex – $bel(Spx, see(Px, Ex))$.

A limit case of this ocularization category, is present in the *Lady in the lake*[12]. In this film each character or object is staged from the point of view of

11 To note also that the 1) has also the implication $bel(Spx, Ey)$, in this redundant case, as the spectator has still inferred this belief by the act of vision.

12 On Wikipedia there is an interesting comment regarding the movie [LadyInTheLake]: "The particularity of this movie is that it has been almost entirely filmed in subjective, by showing the protagonist only at the beginning, in the middle, and at the end of the movie. Thought to

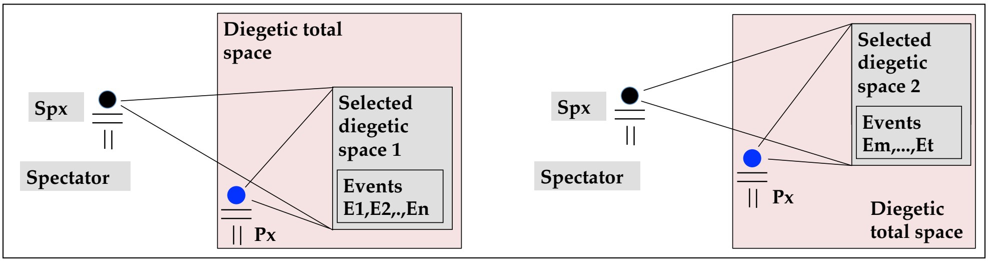


Figure 6.2.5: The spectator sees what a character sees

the main character – the camera exactly shows what the character sees. The failure of the lack in identification of the spectator with the story (pointed out by many critics) derives from the erroneous supposition that showing always what the character sees, it increases the identification. In my opinion, if you give the spectator an eye to record everything a character sees, we can substitute the spectator to the character. With this operation the director takes into consideration what the spectator would feel in place of the character, while in my opinion to create an identification with the character it occurs showing the character's emotions to the spectator. In the vision of some stories the spectator is more touched when he sees someone crying his died beloved, than when he just sees the dead person – so also when in the final part of many stories of spatial adventures in the control room, after the danger has been eliminated and the mission has had success, are reported the shouts of satisfaction, the hugs and the crying of joy of the characters who had participated to the operations. For all these images the spectator is touched. The emotion can be *transferred* by the film to the spectator – only through the characters' emotions during the staging, without which there is not identification.

SECONDARY INTERNAL OCULARIZATIONS. A very frequent scheme of ocularization is called secondary internal ocularization, in which in two alternated sequences are reported, in a first sequence S1 the showing the di-

let identify the public in the happening, to let him participate in a first person, it has proved a clamorous failure. Really it is just the lack of the sight in the character to don't permit the identification, as the spectator is not able to understand which feelings and which emotions he has to feel. Contrary, the lack of the reverse shot and of the objectivity, to which the public is accustomed, make the situation disorientating; and besides the sight direct to the camera of the characters speaking with the protagonist, it puts the viewer uncomfortable"

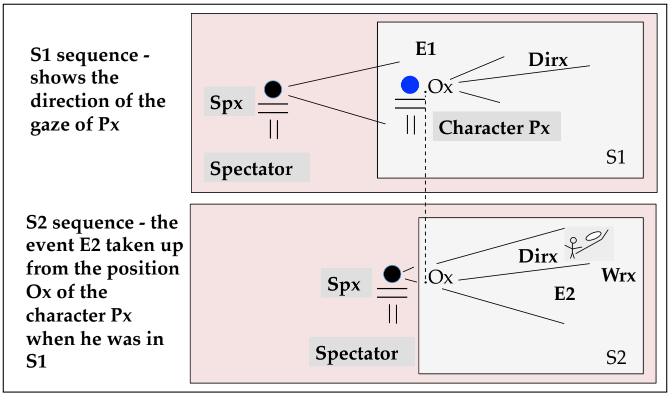


Figure 6.2.6: Scheme for the internal secondary ocularizations

rection of the sight of a character Px (event E1), and in a second sequence S2 an event E2, diegetically filmed in the same observation point of Px in S1 (to observe the two sequences S1 and S2 in figure 6.2.6). This technique allows the spectator to believe that Px sees the event E2. I report in a formal manner this model[13]: Spx believes that Px sees E2 if Spx believes: E1 happens; Px takes part in E1; the gaze of Px is in the direction Dirx; E2 happens; E1 and E2 are visually contiguous; E2 happens in the space Wrx; Wrx is in the direction Dirx; E3 is a diegeticEvent. Formally:

$$\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{what}(E3, \mathit{see}(Px, E2)))) \leftarrow \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, E1)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{who}(E1, Px))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{what}(E1, \mathit{gaze}(Px, Dirx)))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, E2)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{visContiguous}(E1, E2))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{where}(E2, Wrx))), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{app}(Dirx, Wrx))), \\
&\quad \mathit{diegeticEvent}(E3).
\end{aligned} \tag{6.2.4}$$

13 A model of primary internal ocularization has been introduced by [Branigan1992] - the knowledge of this model has been made through the italian version given in [Rondolino2011] p. 150). My model compared to Branigan's model has additional components, and all components have a strictly cognitive characterization.

The camera that has to shoot the event $\mathsf{E2}$ is placed on the point Ox. This point (also if it is not present in the formulation) is the element that contributes to respect the condition $\mathsf{bel(Spx, app(Dirx, Wrx))}$. In fact by putting the camera in that position, the spectator believes that the character Px sees the event $\mathsf{E2}$, this is inferred by the fact that Ox is the point from which Px was looking in the previous scene $\mathsf{S1}$ (sees figure 6.2.6). The conclusion of the inference 6.2.4, allows the application of the 6.2.2, ($\mathsf{bel(Spx, what(E3, see(Px, E2)))}$ it is just the condition 3 of the 6.2.4), and let acquire to the spectator the belief $\mathsf{bel(Spx, bel(Px, E2))}$. According the considerations until now made, in the group of secondary ocularizations belong also the so called *mechanic subjective*, where the "eye through which I see it is no more the one of a man, but the one of an artificial eye"[14]. This sight creates an "empty subjective"[15]:

> In all these cases, the subjective is empty because it lacks in humanity and that makes sense. This fact is not necessarily negative, as to promote objects to protagonists of the sight, it means showing that men and things can exchange their positions (things *see* as men, men *feel* as things, but without the ancient fears of reification, and as suggestion of new life possibility).

Examples of empty subjectivity are present in *O Brother, Where Art Thou?*[16], in the sequence of the wave that overwhelms the escaped from prison – before the wave overwhelms them, the water sees them – or also in Robin Hood[17] by Ridley Scott, the arrow thrown by Robin Longstride (Russel Crowe) in the end of the movie the eye looking is that of the arrow – in all the route stretching from Robin (the one who shots the arrow) until the neck of the traitor in which the arrow will stick itself. I report that in the movie by Kevin Reynolds *Robin Hood – Prince of thieves*[18] having the same cinematographic subject, there is another arrow shoot by Robin Hood (Kevin Kostner) – this time to save little John's son life. There is an eye (a camera) travelling in a parallel way to the arrow, and filming all the way through. This latter example

14 The quotation is in [Rondolino2011] p. 162, while the notion of point of view of the materia is given by T. Garcia [Garcia2009] p. 163.

15 The definition is given in [Buccheri2000] p. 20.

16 *O Brother, Where Art Thou?* [OBrother] is a film direct by Joel Coen and Ethan Coen, starring George Clooney, John Turturro, and Tim Blake Nelson

17 [RobinHood2010]

18 [RobinHood1991]

Figure 6.2.7: Distorted ocularization in *The Double Life of Véronique*

belongs to the category of zero ocularization, while the example of the arrow of Ridley Scott's Robin to that of secondary ocularization.

DEFORMED OCULARIZATION. This kind of ocularization belongs to the category of secondary internal ocularization – it is a subjective realized with metatextual elements present in the representation. Through this type of ocularization, a state of hallucination is represented with deformed or blurred images – a state of inebriation through alcohol effects of a character, as a pavement moving under character's feet, and so on. The cognitive rule is that the deformation shown on the screen, it is attributed at the state of a character (ill, stumbled, precarious and so on). For example the spectator believes that a drunk character sees a room or a road twisting. So, if the spectator believes to have seen a deformed road, he believes that it is the looking of a drunk character and if there is a man Px present in the current sequence (or in that previous) then the spectator believes that it is Px to see that deformed scene.

$$\begin{aligned}
&mev(Tx, bel(Spx, what(Ex, see(Px, Ex)))) \leftarrow \\
&\quad mev(Tx, bel(Spx, Ex)), \\
&\quad mev(Tx, bel(Spx, who(Ex, Px))), \\
&\quad mev(Tx, bel(Spx, adjEv(Ex, distortedVisualization))), \\
&\quad mev(Tx, bel(Spx, propEv(Ex, prop(physicalState, Px, drunken)))).
\end{aligned} \tag{6.2.5}$$

The inference 6.2.5 has been written for the case Px "drunken" – we can generalize with a condition in Or of anomaly physical state of characters, justifying the deformed visualization of the events:

$$\begin{aligned}&\mathsf{bel(Spx, propEv(Ex, prop(physicalState, Px, drunken)));}\\&\mathsf{bel(Spx, propEv(Ex, prop(physicalState, Px, sufferer)));}\\&\mathsf{bel(Spx, propEv(Ex, prop(physicalState, Px, hallucinated)));}\\&\ldots;\end{aligned}$$

In 6.2.5 it appears again the condition $\mathsf{bel(Spx, what(Ex, see(Px, Ex))}$, permitting of applying the cognitive rule 6.2.2. An example of deformed ocularization is present in *Double Life of Véronique* di K. Kieslowski [DoubleVieVeronique], in which in two scenes in succession, is reported Veronika beginning to feel bad and images of events shot by an inclined 45 grades camera representing the vacillating of Veronika's mind. In this case the fourth condition of the inference 6.2.5, assumes the value:

$$\mathsf{bel(Spx, propEx(Ex, physicalState(Px, bad)))}$$

OCULARIZATIONS THROUGH A MEDIA. A secondary internal ocularization possessing specified tracts, is the one representing a media point of view, that is some events in the story are reported through a video, a television or radiophonic transmission, a photo, an audio recording and so on. I have presented this modality in the paragraph 5.3 – I shortly take once again the argument to emphasize that it is a particular ocularization, in which the spectator doesn't apply any kind of filter to accept as true the content of events reported from a television transmission or a photo on a newspaper – for every news reported through a media, the spectator assumes it has truly happened in the story. The content transmitted by a media is not in a zero ocula-rization regime, but in the one of secondary ocularization – as it was *a person speaking*. The transmitting of a media practically possesses all the characteristics of the telling of character. Differently the events reported by the media:

- happen in the time of the enunciation (case of live show), or
- have happened in an antecedent time to that of enunciation (case of a news bulletin).

6.3 INTERNAL COGNITIVE STATES OF CHARACTERS THROUGH THEIR BEHAVIOR

Although in the diegesis we can't represent the mental state of a character Px, we can represent his behaviour (movements of the body, face expressions, a sorrow, a joy, ecc.) or also a behaviour of other characters when observe Px's behaviour. Such diegetic representations (explicitly shown) permit the spectator to acquire beliefs on the internal cognitive state of Px. For these assumptions of beliefs is valid the meta-rule (already introduced) that beliefs recording of an character's internal state occurs after the recording of the spectator's beliefs, assumed in correspondence of a zero ocularization (direct vision of events):

$$\begin{aligned}&mev(Tx, bel(Spx, E1)), mev(Tx, bel(Spx, E2), .., \\ &mev(Tx, bel(Spx, En)) \quad (\cup_i mev(Tx, bel(Spx, E_i)).\end{aligned} \tag{6.3.1}$$

and then with the application of additional cognitive rules ($\cup_v R_v(Spx, Tx)$), present in the spectator at time Tx, leading to the generation of a new cognitive state, represented as:

$$\begin{aligned}&mev(Tx, bel(Spx, bel(Px, Es)), \\ &mev(Tx, bel(Spx, int(Px, Et))), .., \\ &mev(Tx, bel(Spx, bel(Pz, Ez)))\end{aligned} \tag{6.3.2}$$

The characters' internal cognitive states just reported, are ocularizations of order one. The rules $\cup_v R_v(Spx, Tx)$ are of different kind, in chapter 4.2 I have analysed the remembrance of a character, I discuss in this paragraph other categories.

ACQUISITION OF CHARACTER'S INTENTIONS FROM THEIR BEHAVIOUR Acquisition of spectator's intentions often depend by the particular actions that a character performs. For example, if a character Pa hides himself and observes from afar another character Pb, then the spectator believes that Pa has the intention to don't be seen by Pb. In this case, it is the specific action ”to hide” that generates the belief on Pa’s intention. Formally[19] :

$$-mev(Tx, bel(Spx, int(Pa, see(Pa, Pb)))) \leftarrow \\ mev(Tx, bel(Spx, hide(Pa, Pb))). \tag{6.3.4}$$

In *21 grams*, Paul follows at a distance Cristina – he observes her when she is in the swimming pool – he has the intention to make familiar with Cristina, observing her without being seen – the spectator believes that Paul has this intentions, in according to his behaviour.

Generally in every situation in which a character performs a determined action, failing to reach an objective more times, the spectator believes that character has the intention to reach that objective. This general rule is supported by some theories that on the intention of a rational agent have been proposed – among these an important theoretical proposal is the one by P. Cohen and H. Levesque. In a famous article of this authors, with the title that seems a slogan “Intention is choice with commitment”[20], emerges the rule in which if an agent Ag choses a determined objective Ex and undertakes to achieve it, then Ag has the intention to cause the occurrence of the event Ex.

ATTRIBUTION OF CHARACTER’S GOALS THROUGH THEIR INTENTIONS. It exists a rule formulated in the ambit of the agents theories[21] in which if an agent A has the intention to reach a determined objective Ex then A has among his aims Ex:

$$goal(Px, Ex)) \leftarrow int(Px, Ex))$$

I rewrite the latter rule in the form of spectator’s inference in the way:

$$mev(Tx, bel(Spx, goal(Px, Ex))) \leftarrow mev(Tx, bel(Spx, int(Px, Ex)))$$

19 The rule 6.3.4 is a version of the equivalent rule:

$$mev(Tx, bel(Spx, int(Pa, \neg see(Pa, Pb)))) \leftarrow \\ mev(Tx, bel(Spx, hide(Pa, Pb))). \tag{6.3.3}$$

20 [Cohen1990]

21 Consider the work by Rao and Geogeff [Rao1995]

Through the cognitive rule of the kind just given, we can represent revision rules of spectator's beliefs, keeping into account what has been perceived by some character inside of a story (in correspondence of a character Px says or sees that a determined event has happened).

6.4 ATTRIBUTIONS OF BELIEFS THROUGH THE DREAMS OF THE CHARACTERS

The representation of a dream is the following:

$$bel(Spx, who(Ex, Ey)), bel(Spx, what(Ex, dream(Pa, Ey)))$$

where the subject of a dream Ey is a character Pa. On the contrary to what happens for many figures of the cinematographic telling, frequently the dream is not previously signaled by some specific events (for example, showing a person going sleeping). The viewer often becomes aware that Ey is a dream, after having seen a group of story events that he (erroneously) believed belong to the reality – for example when it is reported the awakening of a character Px without having shown in the story Px going sleeping.

I report some frequent cases of dreams representation. The dream as **remembrance** (for example the sequence of the clock story in *Pulp Fiction*) – in which such events not belonging to reality, when have been recognized (often the spectator has some difficulties to recognize them), are part of the character's story – in such way they have the same function of a flashback, that is to present some past events of a character's life. The dream as **nightmare** – in which the events reported nearly always didn't happen in reality. The spectator individuates the nightmare through some events that put at risk the character, and the sudden awakening marks it. Generally, a nightmare is always an event not wished by the character:

$$bel(Spx, what(Ex, \neg goal(Pa, Ey)))$$

The dream as **projection** of the character – that have to be interpreted as desire (objective or aim) of the character, that is:

$$bel(Spx, what(Ex, goal(Pa, Ey)))$$

Characters' projections often happen as a **daydream** and are identified by the viewer through a close range shot of a character's face, in the same way as it occurs for some flashbacks of thought (topic presented in 4.3). The dream as **enigma** – which can constitute something to solve right after the presentation of the dream itself – or also in the following of the story. The dream as enigma is often reported several times in a story (to consider for example the movie *Twelve Monkeys*, when the memory of the killing of a man inside an airport often comes back to the protagonist's mind).

6.5 FOCALIZATION AS SPECTATOR'S BELIEFS

The focalization has been inserted in this chapter as argument of discussion as spectator's mental states are determined in relation to the quantity of spectator's knowledge about the facts of the story and about characters' inner states (characters' knowledge). Examples of such states are the surprise and the suspense, which play a role often central in the fruition and comprehension of a story. With the term focalization[22] "we intend the way in which the relation of knowledge among narrating instance, character and spectator are regulated inside of a telling". The focalization unlike the ocularization does not deal with the way with which knowledge about a story is created. In this paragraph, I will give a definition of focalization, in which instead of the spectator and the story characters' knowledge, I adopt respectively the *direct* beliefs of the spectator on the events and other beliefs (on the same events) that spectator attributes as belonging to the internal beliefs of the characters.

22 The definition is given in [Rondolino2011] p. 41

I start from the (classical) definition of focalized narrative outlined by G. Genette[23]:

- nonfocalized narrative (or with zero-focalization) is the omniscient narrative in which the narrating instance says more than what the characters know (narrator > character);
- narrative with internal focalization, in which the narrating instance takes a character's point of view by saying only what such character knows (narrator = character);
- narrative with external focalization, where the narrating instance doesn't let know character's thought, and says less than what the character knows (narrator < character)

Regarding the rewriting of the three definitions, I propose a refinement of the focalization concept, inserting the notion of the grade of focalization and defining it with respect to the characters, and the narration intervals. In this way my objective is to define a measure of focalization, that can be used in a large number of stories, defined on the characters' beliefs in a determined instant Tn of the narration time. I moreover believe that, for a focalization measure it is not important to specify the way in which the narrating instance says, shows or generally transmits to the spectator the knowledge of a story, or which inferences the spectator adopts to assume the beliefs relating to the story events. This topic is determinant, as we have seen, for the ocularization models, while I believe that it is not determinant for those related to the focalization.

In paragraph 2.5 I have presented a principle of perception-belief – in which everything shown in the diegesis and so by the speaking instance, is recorded as a spectator's belief.

Regarding measure of focalization I will take into account, instead of the knowledge possessed by the narrating instance, the spectator's beliefs on the story events:

$$IP(Tn, Spx) = \cup_j [Tn] bel(Spx, E_j) \qquad (with j = 1, k)$$

23 The concept of focalization is due to G. Genette [Genette1986] pp. 336-337, the schematization I textually give is present in [Rondolino2011] p. 42

That is, the union of all the beliefs about the story events E_j possessed by a spectator Spx at time Tn.

The other definition I need to take into account, for my focalization, is the set of the beliefs that the spectator Spx attributes to a character Px at the time of the narration Tn, we are going to indicate with the term $BintA$ (internal belief of Px attributed by the spectator)

$$BintA(Tn, Spx, Px) = \cup_i [Tn] bel(Spx, bel(Px, E_i)) \qquad (with\, (i = 1, m)$$

When $BintA(Tn, Spx, Px) \subset IP(Tn, Spx)$ holds, he spectator believes that have happened more events than a when character believes have happened – this occurs because the narrating instance has shown to the spectator (in the diegesis) more events than the ones shown to Px (we remember that it is always the spectator to believe that Px thinks that the events have happened). In terms of beliefs, the rewriting of the focalization schemes is the following:

-1 if $BintA \subset IP$ then the narrative is not focalizated (with zero-focalization);
-2 if $IP \equiv BintA$ then the narrative is with internal focalization;
-3 if $IP \subset BIntA$ then the narrative is with external focalization;
-4 if $IP \cap BintA \neq IP$ e $IP \cap BintA \neq BintA$ then the narrative is with multiple focalization.

$IP(Tn, Spx)$ and $BintA(Tn, Spx, Px)$ are the components to determinate a measure of narration focalization. They represent the spectator and character's beliefs according to the narration time Tn, and this measure can change from character to character. In the formulation I have given there is a problem regarding $BintA(Tn, Spx, Px)$, that corresponds to the quantity of beliefs on the events happened, that the spectator attributes to a determined character Px. The problem rises from the fact that the narrating instance, in some movie stories, doesn't always allow to know those beliefs (some events are not shown in the diegesis). An attempt to solve the problem is proposed in [Rondolino2011][24]:

> I have to talk about external focalization not when a character is simply seen from the external, but when from the point of view of the narrative information distribution, it is evident a restriction of our knowledge

24 The text in angle brackets is ours.

<means of the spectator> in relation to the one of the character. The essential question is this: do I know which are the motivation pushing the spectator to act in that way, which the aims of his action, which the feelings he lives? If the question is positive, I am in internal focalization regime, if it is not so, I am in the one of internal focalization.

The method proposed in [Rondolino2011] requires that a spectator Spx through the observation of a character's behaviour Px (in a previous diegetic time Ti-1) builds same hypotheses at time Ti on the internal state of Px (with $Sc(Px)$ I intend not only the beliefs of a character Px, but also Px's desires and intentions) and Spx also owns the abdutive implication:

$$Sc(Px) \Rightarrow Comp(Px)$$

On this methodological course I have to consider that the spectator can hypothesize that exists more than Px's cognitive state in correspondence of observed Px's behaviour ($Comp(Px)$), that is:

$$\begin{array}{l} Sc1(Px) \Rightarrow Comp(Px) \\ Sc2(Px) \Rightarrow Comp(Px) \\ ,\dots, \\ Scn(Px) \Rightarrow Comp(Px) \end{array}$$

Very often to solve this latter problem, there is the ability of the film director to stage a behaviour $Comp(Px)$ allowing the spectator to reduce the number of the suppositions $Sc_i(Px)$ and the ability of the same spectator to select the right presupposition:

$$Sc_i(Px) \Rightarrow Comp(Px)$$

The method presented in [Rondolino2011] anyway is not applicable in all the cases – in a film story situations can be presented in which the behaviour $Comp(Px)$ of the character Px is not shown (or it can not be inferred) in the diegesis – in all these cases the spectator is not able to make any suppositions to choose a particular cognitive state $Scx(Px)$ of the character Px.

In many stories the spectator is able to know all the beliefs of a character Px on the story events, only in the end of the telling, when at that point of the narration the spectator is able to discover all the inner beliefs of the character Px.

In the *Usual Suspects* the spectator only in the end of the movie believes that Keyser Söze (a cruel killer) is Roger ”Verbal Kint” (Kevin Spacey) – a character that appears with few relevant properties, until the end of the narration. The spectator discovers that Verbal – has hidden, for mostly of the narration, an important truth and realizes that the narrating instance (constituted by the narrative voice of the same Verbal) knew more than he. In this case (as I have seen also in *Rashmon*) – the text lies – Verbal (the narrating voice) tells a lie during his telling:

> I couldn't understand why I was there. I mean, those were serious thieves. Anyway, I was there. At that point I wasn't afraid. I Knew I had not done anything for which they could incriminate me. And it was funny. I could pretend to be a big shot.

A measure of focalization can be constructed so, only at the moment of the revelation of every *hidden* knowledge and every *truth*. The spectator has to re-examine the telling, remember the words and the behaviour of the character and compare them with new acquired events, to reconstruct the story in light of the facts he wasn't aware about. The described operation to measure

Figure 6.5.1: *The Usual Suspects* [TR=08:06]

the focalization is enough expensive – but it is also the more correct, as the spectator has to perform a reinterpretation of all story events in the light of what he discovers on the characters' beliefs.

An alternative measure of focalization could be defined through a second reading of the film - although this operation is performed using also knowledge about story events in advance in respect with the time in which they are enunciated in the narration. The comparison between the two kinds of focalization measures reported is the following:

- the measure based on spectator's remembrance at the end of the telling, although more faithful to what happens in the cognitive processes of the spectator, presents modelling problems as it is difficult to define a criterion on what (the events) the spectator is able to remember at the end of the telling;
- through a measure of focalization based on a second reading of movie - we can, with few difficulties in the modeling, to hypothesize the events remembered by the viewer, even if such model is not faithful to what happens in the cognitive processes of a generic spectator.

6.6 FOCALIZATION AND SUSPENSE

The condition narrator > character, called spectatorial focalization, can generate a particular suspense in the spectator. This happens for the different knowledge the spectator and the characters possess: the spectator believes that have happened more events than a character believes to have happened. For example in the typical situation of Hitchcock's suspense the spectator Spx believes that the killer is hidden behind the curtain, but the spectator also believes that a determined character Px doesn't believes it. An inferential rule characterizing many suspense situations is the following:

$$
\begin{aligned}
& mev(Tx, addBel(suspense(Spx, Ex))) \leftarrow \\
& \quad mev(Tx, bel(Spx, Ex)), \\
& \quad mev(Tx, bel(Spx, who(Ex, Px))), \\
& \quad mev(Tx, bel(Spx, \neg bel(Px, Ex))), \\
& \quad mev(Tx, bel(Spx, propEx(Ex, prop(dangerousness, Px, high))))).
\end{aligned}
\tag{6.6.1}
$$

In the inference 6.6.1 the condition 5 assures the implication 1, if in Ex it is present an high danger for Px. Obviously the one shown is a particular suspense (the Hitchcock one) that can be created in the spectator[25]. There exist various typology of suspense that can be modelled by using the representation instruments until here given, for example the suspense that involves more of one internal ocularization corresponding to the attribution of beliefs to more than one character of the story.

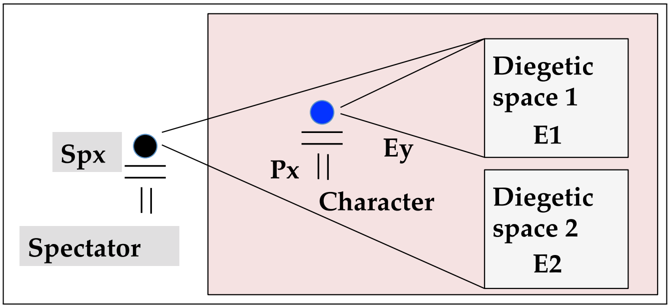


Figure 6.6.1: Suspense through spectatorial focalization

In figure 6.6.1 I report a scheme for the spectatorial focalization that generates a suspense in the spectator. To note that, in the example given, the different quantities of beliefs between spectator and characters, could be also generated by a different staging. For example, in a event Ey is shown (with a zero ocularization) a character Px putting a bomb under the table, or also that Px says to another character that ”he has put a bomb under the table”, and in the following of the narration is reported (through always a zero ocularization) the same character Px discussing quietly with another character – unaware of the danger.

25 It wasn’t among the aims of this book to explore all the possible combinations of ocularization to generate the suspense – a text containing insights in Hitchcock suspense is the one by X. Perez [Perez2001]. To note that in the cinema theories it exists an *opposite* concept the one of surprise, in which the character (or the narrating instance) possesses more knowledge of the spectator. Regarding the modelling of surprise for real life see [Lorini2006], while for those relating to fiction [Mele2002].

6.7 FLASHBACK WITHIN A FLASHBACK – AN INTERNAL AND NESTED FOCALIZATION

The flashback within the flashback is a phenomenon that, also if interesting global structural argument of the telling (theme I are going to take again in chapter 7), involves some aspects related to focalization. It happens a flashback in a flashback when after a flashback has happened, and in the diegesis it is reporting the part of the story relating to the past, another flashback is activated and it brings the story more back into the past. Two example of flashbacks are present in *The Man Who Shot Liberty Valance* and *Canone inverso*[26]. This flashback is completed through a deixis having a large wideness.

(a) TR=01:52:06 **(b)** TR=01:52:38

Figure 6.7.1: Flashback within a flashback in *The Man Who Shot Liberty Valance*

During such flashback, staging through Ramson's narration, occurs another flashback activated by another character of the story – Tom Doniphon (John Wayne): this is also a flashback of thought (internal).

In the scene where starts the flashback within another flashback, Tom's face is closely framed – he is now to remember. Addressing to Ramson he says: do you remember? – but Ramson cannot remember – because Tom has inflicted the definitive shot at Liberty, while he was hidden in the dark in the end of the road – shot that Ramson couldn't have seen starting. The scene of Liberty's killing(Tr = [01:52:38]) is remembered by Tom, but in Tom's narration there

26 *The Man Who Shot Liberty Valance* [LibertyValance] is a movie directed by John Ford, starring John Wayne, James Stewart, Vera Miles and Lee Marvin.

is an *active* action regarding the remembrance by Ramson – technically it is a flashback within a flashback, with a *change* of the character who remembers.

There is an obvious incongruity: how can a character that is reporting a story through images, show what another character has remembered? Certainly through images we can report remembrance of real events, but not the remembrance of other characters. We can not do certain assumptions if this incongruity is perceived by the spectator – we can maybe suppose that he loses in a certain sense *the knowledge* of which character is remembering, in other words loses trace of who is the narrative voice. We are in the statute of focalization presenting a subjective *strangely grafted* – the spectator *follows* the Ramson's thought, who reports both Tom's action and (also if he can't) Tom's remembrance. I believe that the spectator does not see this incongruity, as he attributes at Tom the action of telling, without believing that was Ramson to do it. The spectator before of Tom's declarations, believes that Rasmon believes that he himself has shot at Liberty.

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Ramson}, \mathsf{shoot}(\mathsf{Ramson}, \mathsf{Liberty}))$$

The remembrance and the subsequent happenings reported by Tom, generates the spectator's belief that Tom has shot Liberty:

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Tom}, \mathsf{shoot}(\mathsf{Tom}, \mathsf{Liberty})))$$

For the understanding of story, there isn't a fundamental belief:

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(\mathsf{Ramson}, \mathsf{bel}(\mathsf{Tom}, \mathsf{shoot}(\mathsf{Tom}, \mathsf{Liberty})))) \quad (6.7.1)$$

namely that the spectator believes that Ramson believes that Tom shot Liberty. I believe that the latter belief is acquired by the spectator for that anomalous modality present in the story that regards Tom's remembrance, which he seeks to involve Ramson saying "do you remember?" As already mentioned Ramson can not remind the remembrance of another character – Tom included. This kind of *transmission* of thought, is interpreted by the spectator as a specie of verbal communication between Tom and Ramson, in which Tom tells Ramson that he himself has shot Liberty – for this reasons I believe it is valid the 6.7.1.

Another flashback in the flashback, with the same characteristic of the one present in *The man who killed Liberty Valance* appears in the movie *Canone inverso*. Costanza (Nia Roberts) tells (figure 6.7.2a) to have met a (figura 6.7.2b) violinist (Gabriel Byrne), a man who has played an inverse canon in a pub. In Costanza's telling (that is already a flashback form) starts another internal flashbacks activated by the telling of a violinist (figure 6.7.2c9). Also in this case it is a flashback in the flashback, and also in this case we can suppose that the spectator doesn't answer to the question "who is remembering?" and that is once again *narcotized by the story*, interested to know through the events collocated inside in the time, the explanation of why a violinist present himself in a public place, and plays an inverted canone to an unknown.

The spectator once again is *narcotized by the story*, and has the main interest to know through the story events the explanation of why a violinist presents himself in a public place, and plays an inverted canone to an unknown.

(a) Constance (Nia Roberts) tells to the old Baron (Peter Vaughan)

(b) Constance tells to the old baron of a violinist (Gabriel Byrne) who tells

(c) The violinist (Gabriel Byrne) tells of a young violinist

Figure 6.7.2: Flashback within a flashback in *Canone Inverso*

Part V

Stories

7 TEMPORAL STRUCTURES OF STORIES

In the previous chapter I have introduced some models of the spectator's reasoning activities represented as cognitive local phenomena. That is, through the spectator's cognitive state in a temporal instant and what stems from the vision of the next visually contiguous event in the telling. In the chapters 3, 4, 5 and 6 I have modelled as local phenomena flashbacks, flashforwards, ellipsis and temporal deixis. A global phenomena is instead a phenomena relating to n spectator's cognitive states, such as the linearity of a story, where for every pair of events Ex, Ey the spectator believes that if Ex precedes Ey in the telling, then Ex precedes Ey in the story; the temporal consistency of a story, in which for every couple of event Ex and Ey, you don't have to verify that the spectator can infer that exist two events Ex and Ey in which Ex happens before Ey, and it is also valid that Ex happens after Ey; the focalization, that is the property that we attribute to a whole telling (or part of it) when a spectator has (more, or less) the same knowledge of the narrative voice (about this argument I have already discussed in the paragraph 6.5 relating to the focalization).

It is clear that for brief segments of the telling, the spectator possesses elements to establish if the story is linear or not linear, so he has also elements to label local inconsistencies, or also to evaluate if the telling is focalized or not. Structural characteristics of an entire story, also if constructed by local properties of the same story, regard theoretical aspects that are not possessed by a generic spectator.

In this chapter I give some global structural properties of movie stories and I will try to classify them according to the (local) temporal anchoring mechanisms activated by the spectator during the movie vision. In such a way a category of story is characterized by the cognitive abilities that the spectator shows to possess. If for each kind of anchoring there is a correspondence with one or more cognitive activities of the spectator, for some global properties of a story, a correspondent cognitive activity could not exist – the spectator could

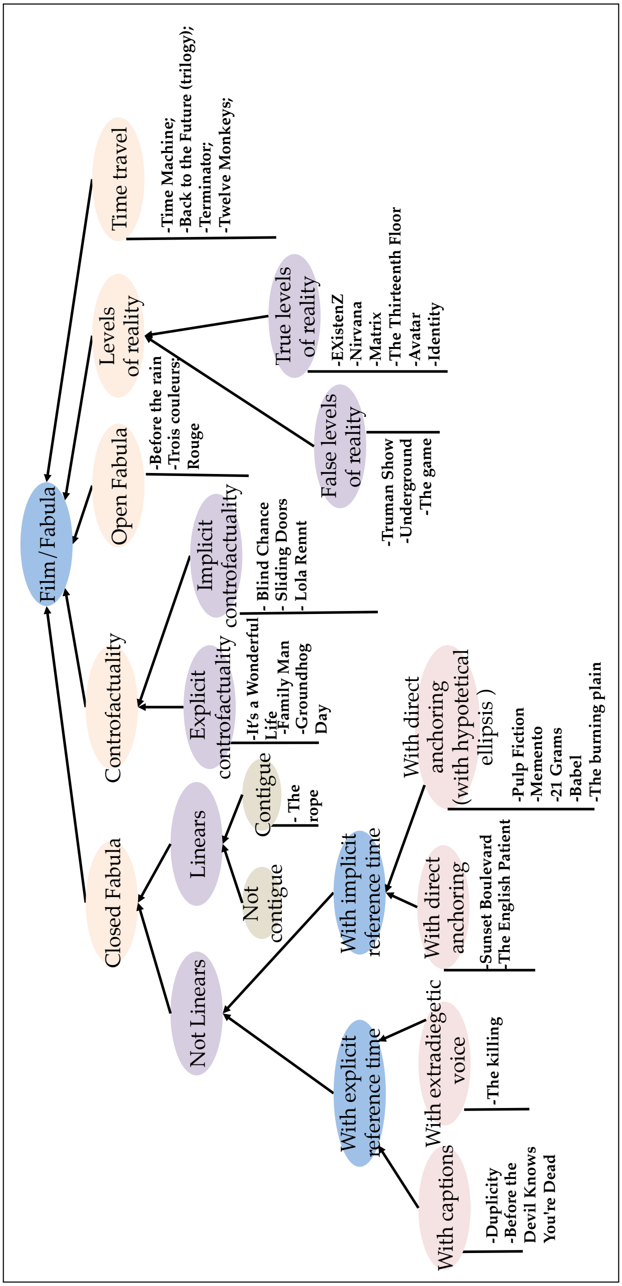


Figure 7.0.1: A taxonomy of movie narrative structures

haven't inferential abilities or competences to establish if a story is consistent, linear or if it has a determined grade of focalization. This classificatory operation is not executed by a generic spectator, who is mainly interested to the comprehension of the story, not to its global properties.

The analysis of the last requires instruments that aren't generally possessed by the spectator[1]. These analysis, are made generally by a cinematographic theorist after that the movie is ended. In this chapter, I characterize determined structural properties that will be taken into account to classify a story considered as global entity. I desire to clarify that the name of the categories we attribute to the stories, denote only predominant characteristics – this means that every story, besides possessing one or more properties characterizing it, can possess also other global properties. For example a story classified as counterfactual for the existence of two events mutually exclusive, does not exclude that in the same story are present (also for longer parts) segments of movie with linear characteristics.

In this chapter, I give a formal representation of macro event, entity I have individuated as cognitively meaningful to represent basic elements of a story. According to this notion of macro event, I describe the mechanism through which partial stories of a telling are aggregated to form the whole story of the movie. There are partial stories, events or macro events that for long parts of the telling aren't linked to other parts of the story – in the almost totality of the cases all parts are connected in the end of the movie. In such a way in a movie, a partial story is dynamic entity that is, subjected to aggregate and to change characters and places when the telling goes on.

In *21 Grams* and *The Burning Plan* for example, the initial part of the story is divided in N partial stories that in the end of the telling are linked. Two partial stories that formerly were not linked, can be linked in an only story, if the spectator believes there is a relation to link them. In this context of inquiry, generally the fabula of the whole movie is constituted by partial stories (excerpts of stories) having some relation among components of the events (among places, characters and so on). The belonging of an event to a story, sometimes can be deducted from the presence of an explicit filmic punctuation

1 a pivotal point in the filmic theory is, too often, to consider himself more intelligent then of the films that he treats, having the presumption to teach them (and to their spectators) what they "really" are talking about.

announcing a specific grouping of events – this in a style of classic narration happens by using for example episodes and captions as punctuation.

In this chapter I dedicate some paragraphs to the stories having an **high fragmentation** – among these I analyze the ones using temporal explicit utterances – which mark the passage from a group of events to another, as occurs for example in *Before the Devil Knows You're Dead* through superimposed captions to images, or in *The Killing through an extradiegetic voice*. I analyze also the stories presenting implicit temporal jumps, that is, having radical changes of characters and places, without an explicit signaling. In these last types of stories, the spectator is obliged to activate complex cognitive rules of anchoring, with the aim to reconstruct the story axis – I refer to movies with complex plots such as *21 grams* and *Babel*.

7.1 LINEAR STORIES AND STORIES WITH CONTIGUOUS EVENTS

In relation to the story (or to part of the same) the term continuous is often used by cinema theorists with some ambiguity[2] – that according to us can be replaced by two definitions with a two precise semantics: linear story and story with contiguous events. The linearity of a story is a concept that regards the non-existence of a back to the past of the story. While the contiguity requires that there aren't ellipsis in the story (nor narrative ellipsis, nor intra-sequential ellipsis).

Formally a **story is linear**, if for every couple of visually contiguous events Ei -Ej (with spectator's beliefs bel(Spx, Ei) and bel(Spx, Ej), Ei, precedes Ej in the story (bel(Spx, prec(Ei, Ej))) (see figure 7.1.1). A story is with contiguous events – we will say **the story is contiguous** - if in correspondence of every couple of visually contiguous events Ei -Ej, Ej follows in the story immediately after Ei (bel(Spx, meets(Ei, Ej)) (see figure 7.1.2). The stories totally contiguous are little frequent – they are stories that happen generally

2 In Mouren's book *Le flash-back* [Mouren2005], the term "countinuos" has frequently been used

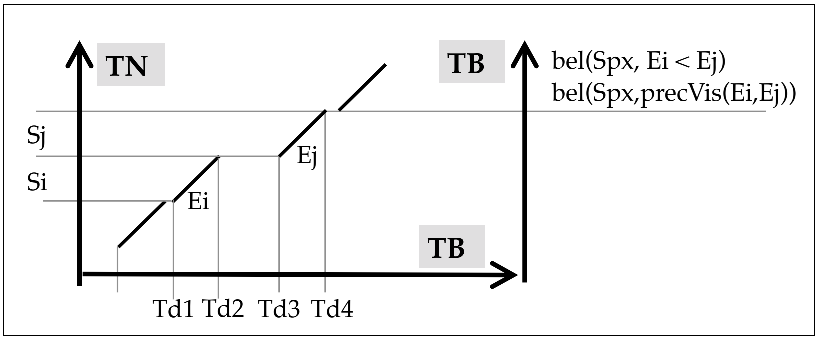


Figure 7.1.1: Linear stories

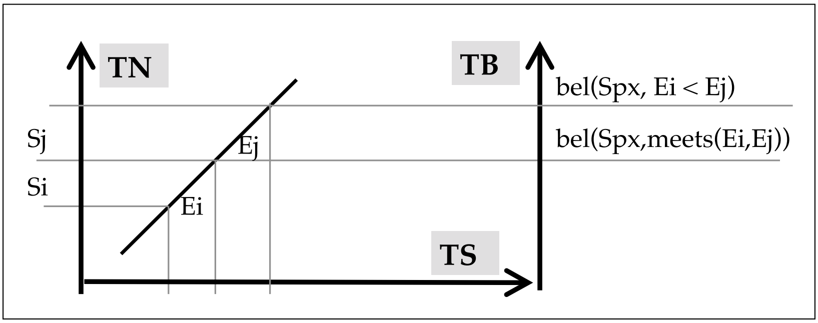


Figure 7.1.2: Stories with contiguous events

in an only spatial context – examples of these stories are *Vanya on on 42nd Street, Carnage*[3] and (obviously) *Rope*[4].

3 [Vanyaon42ndStreet]

4 As we know, the temporal continuity of the whole story *The Rope*, has been constructed through a genial artifice by the movie director. "Hitchcock with *The Rope*, directed an extraordinary movie, for a long time unique – he used eight long take (about of ten minutes each), which the interruption between two frames were masked by the same actors movies that, by passing front the obscured camera the images hiding the cuts among these – so as it occurs in the case of a unique plan (simulated) of sequence". In [Rondolino2011] pag. 286.

7.2 MACRO EVENTS, PARTIAL STORIES AND STORIES

In a cognitive approach the event is a fundamental and irreplaceable unity for the segmentation, for the construction of the spectator's cognitive state, and as consequence for the comprehension of the whole story. The traditional movie analysis has accustomed us to consider the sequence and the episode as unity for the analysis of the movie. Unfortunately such entities, especially for the contemporary movies, present many problems if they are taken as basic units for a formal segmentation of movie. Especially for the cognitive aspects *the episodes*[5]can't be chose as base element as it contains many discourse functions — moreover it doesn't possess an important prerogative to be candidate as basic unit, that is the one to reduce the complexity of the analysis film. *The sequence*, if chosen as basic unit for the segmentation, sometimes reduces the complexity of the story analysis (also if often by a cognitive point of view it is a separated unit) in any case it doesn't constitute an unitary element from which starting to execute a useful structural analysis. My point of view is that we need to introduce an entity, having a structure and a typical duration of the sequence, allows us to represent what the spectator thinks when he uses expressions such as: "the meeting between Marco and Elisa" , "the episode of the rapture of the girl", "the part in the movie in which the protagonist pretends to die", " when Elisa chases Sandro", "the time John remained in that house", and so on. Locution such as "meeting", "episode", "part", "when", "all the time that", are used to indicate, in segments of stories, expressions reflecting the spectator's mental representation, starting from these, he constructs inferences, performs anchoring and feels emotions. I will call these unitary segments of the story as **macro events**. In the next paragraph, I will show that a macro event, also if composed of a set of events, has the same base structure of a simple event and allows us to deal with a series of events as a unique entity.

5 The episodes "represent the wider partition of a movie, linked to the inner presence of a film with more stories or more phases markedly different of a story... the space is defined by the set of all the elements hosting the sequence of the events and that represent its background" (definition given in [Casetti2009]).

A macro event possesses: the "when" component, the time interval in which happens a macro event (formed by the union of the intervals of the single events, from which the temporal extension of the whole macro event can be determinated); the "where" component, defined as the union of the single places where happen the events; "who" component, determined by all participants to the single events; and in the end the "what" component, i.e. the set of all the actions present in the events belonging to the macro event.

As narrative structures the macro events are integral parts of the spectator's cognitive space and have particular properties, I report.

In the similar way to the characters' names and to the events, every macro event has (almost always) a name in the form of epithet. An important attribute of a macro event is that of the participant, that often gives the name of the macro event. The attribute *participant* (the attribute *Who*) of a macro event is constituted by the totality of characters present in the events belonging to the macro event taken into account. During the visualization of a macro event, the number of characters present in the story can vary, we however need to consider that every variation of characters is always associated with a justification inside of the macro event. If for example in a macro event a character leaves a group of friends (in this way the number of characters varies), the spectator possesses always a belief that explains why the character has left the macro event – he has to take his daughter at school, has to go to work or has an appointment, etc. The same is for every character *entering* in a macro event space – there is always an event justifying about why at that moment he entered in such diegetic space. In every case the total number of characters in a macro event can be always determined.

A macro event has a place in which it occurs, or a set of places where the events happen (attribuite *where*). The *where* to be a basic unity for the macro event. It is necessary that every change of the story place, has to be followed by the spectator's belief that the space is changed because of characters' movements – we say in this case that the diegetic space of a macro event can change (it extends) if exists a travel justifying such change.

Another attribute of a macro event is that of the temporal set in which it happens (the attribute When) – constituted by the union of the temporal intervals of the single events. We can consider the temporal extension of a macro event, as the temporal interval stretching from the beginning instant of the first event, to the ending instant of the last event of the macro event.

A COMPUTATIONAL MODEL FOR MACRO EVENTS I report a model for a macro event assuming that membership of an event to a macro event is a relationship that is established whenever the viewer believes an event occurs in the diegesis – so we can assume it is born as spectator's belief after a specific act of vision $visActMc$:

$$\begin{aligned}&mev(T2, addBel(bel(Spx, belongMacr(Ex, Macrx)))) \leftarrow \\ &\ visActMc([T1, T2], Spx, Segx, Macrx, Ex), \\ &\ hasIntTime(Segx, [T1, T2]), \\ &\ spectator(Spx), \\ &\ diegeticEvent(Ex), \\ &\ macroEvent(Macrx),\ \ time(T2).\end{aligned} \tag{7.2.1}$$

I provide the inference relative to two events $E1$, $E2$ belonging a same macro event:

$$\begin{aligned}&mev(Tx, bel(Spx, sameMacrE(E1, E2))) \leftarrow \\ &\ \ mev(Tx, bel(Spx, belongMacr(MacrE1, E1))), \\ &\ \ mev(Tx, bel(Spx, belongMacr(MacrE2, E2))), \\ &\ \ mev(Tx, bel(Spx, visualContinuous(E1, E2))), \\ &\ \ mev(Tx, bel(Spx, notBreak(E1, E2))).\end{aligned} \tag{7.2.2}$$

The condition $mev(Tx, bel(Spx, noBreak(E1, E2)))$ can be acquired by the viewer, beyond a non-explicit presence of a break in the story[6], even by different filmic situations, each one sufficient to bring the viewer to believe there was no break of the story. There is not a break between $E1$ and $E2$ if $E1$ and $E2$ belong to a same ordinary scene. Formally[7]:

$$\begin{aligned}&mev(Tx, bel(Spx, noBreak(E1, E2))) \leftarrow \\ &\ mev(Tx, bel(Spx, sceneOrd([T1, Tx], [E1, E2]))), time(T1).\end{aligned} \tag{7.2.4}$$

6 In a generic logic programming the non-explicit presence of a break can be represented in a simple way as

$$\begin{aligned}&mev(Tx, bel(Spx, notBreak(E1, E2))) \leftarrow \\ &\ not\ mev(Tx, bel(Spx, break(E1, E2))), \\ &\ diegeticEvent(E1), diegeticEvent(E2), \\ &\ time(Tx), spectator(Spx), E1! = E2.\end{aligned} \tag{7.2.3}$$

7 The definition of ordinary scene $mev(Tx, bel(Spx, sceneOrd([T1, Tx], [E1, E2]))$ have been reported in 3.2.1, chapter 3

There is not a break between $E1$ and $E2$ if $E2$ meets $E1$.

$$\begin{array}{l} mev(Tx, bel(Spx, noBreak(E1, E2))) \leftarrow \\ \ mev(Tx, bel(Spx, meets(E2, E1))). \quad \text{\% E2 meets E1} \end{array} \tag{7.2.5}$$

There is not a break between $E1$ and $E2$ if $E1$ and $E1$ belong to a same diegetic space.

$$\begin{array}{l} mev(Tx, bel(Spx, noBreak(E1, E2))) \leftarrow \\ \ mev(Tx, bel(Spx, where(E1, Wr1), \\ \ mev(Tx, bel(Spx, where(E2, Wr2), \\ \ mev(Tx, bel(Spx, sameWr(W2, W1))). \end{array} \tag{7.2.6}$$

Finally, there is not a break between $E1$ and $E2$ if $E1$ and $E1$ belong to two diegetic spaces $Wr1$, $Wr2$ spatially contiguous.

$$\begin{array}{l} mev(Tx, bel(Spx, noBreak(E1, E2))) \leftarrow \\ \ mev(Tx, bel(Spx, where(E1, Wr1), \\ \ mev(Tx, bel(Spx, where(E2, Wr2), \\ \ mev(Tx, bel(Spx, spatContiguous(Wr1, Wr2))). \end{array} \tag{7.2.7}$$

The spatial contiguity $mev(Tx, bel(Spx, spatContiguous(Wr1, Wr2)))$ is a condition that can be achieved in many manner – for example by the vision in the story of a character that moves from a space $Wr1$ to a space $Wr2$ ($move(Px, Wr1, Wr2)$).

$$\begin{array}{l} mev(Tx, bel(Spx, spatContiguous(Wr1, Wr2))) \leftarrow \\ \ mev(Tx, bel(Spx, where(E1, Wr1), \\ \ mev(Tx, bel(Spx, where(E2, Wr2), \\ \ mev(Tx, bel(Spx, visualContinuous(E1, E2))), \\ \ mev(Tx, bel(Spx, what(E1, move(Px, Wr1, Wr2)))). \end{array} \tag{7.2.8}$$

In the movie *The Graduate* [TheGraduate], in the final scenes where Ben (Dustin Hoffman) reaches Elaine Robinson (Katharine Ross) on the altar, there are five events: Ben's car run out of fuel ($e1$); Ben runs till the church($e2$); Ben enters into the church($e3$); Ben with the cross threatens to hit Elaine's relatives($e4$); and Ben and Elena catch the bus($e5$). $e1$,$e2$,$e3$,$e4$ and $e5$ belong to an only macro event, as the events are linked by a movement of a character's shown in the diegesis.

Differently from what happens in some changes of the story, in which there aren't justifications of characters or spaces' variations, in which there is a sudden change of characters and places, typical of a break in the story – for example a flashback or an ellipsis.

Formally a macro event of a story:

$$mev(Tx, bel(Spx, macroEv(MacrE, \{E1, E2, .., En\}))) \quad (7.2.9)$$

is a set of spectator's beliefs where, for each pair of visually contiguous events Ei, Ej belonging to the set of events $E1, E2, \ldots En$, the condition 7.2.2 is valid. The spectator records that a set of events belong to a given macro event $MacrEx$, as represented in 7.2.9, whenever in the story break occurs:

$$\begin{aligned} & mev(Tx, bel(Spx, macroEv(MacrEx, ListE))) \leftarrow \\ & \quad mev(Tx, bel(Spx, break(E1, E2))), \\ & \quad mev(Tx, bel(Spx, belongMacr(MacrEx, E1))), \\ & \quad buildEventList(MacrEx, ListE). \end{aligned} \quad (7.2.10)$$

A macro event represents a set of events constituting an useful structure for the story analysis. We can easily demonstrate that:

- every macro event is formed by a group of linear events but the vice versa is not valid, ie every group of linear events not necessarily constitutes a macro event;
- in the case the alternate sequences, every sequence interrupts a macro event, but maintains the linearity among the events;
- the conditions given in 7.2.2, 7.2.4, 7.2.5, 7.2.6, 7.2.7, and 7.2.8 are true for intra-sequential ellipsis, but are not true for flashbacks or flashforwards, neither for an narrative ellipsis.

I give a simple example of macro event, whose story in schematic form is the following (the same macro event is represented through a TN-TS diagram in figure 7.2.1):

A person $p1$ walking$_{e1}$ along a road $wr1$.
[intra-sequential ellipsis [$td2, td3$]].
$p1$ reaches$_{e2}$ the place $wr2$, where he meets two persons $p2$ and $p3$.
$p3$ cheers$_{e3}$ $p1$ and $p2$ and then leave them.
$p2$ and $p3$ set out$_{e4}$.

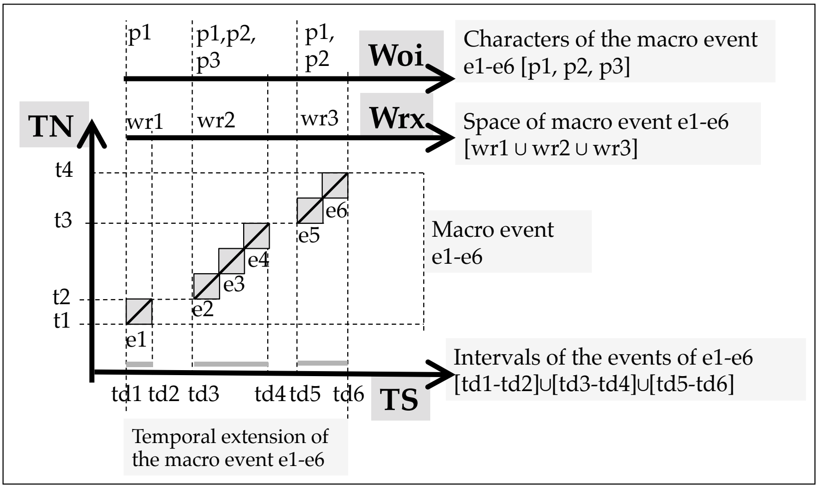


Figure 7.2.1: Macro event representation through a TN-TS diagram

[intra-sequential ellipsis [$\mathsf{td4}, \mathsf{td5}$]].
$\mathsf{p1}$ and $\mathsf{p2}$ have reached$_{e5}$ the place $wr3$.
$\mathsf{p1}$ and $\mathsf{p2}$ converse$_{e6}$.

The example shows a macro event $e1$-$e6$ containing two intra-sequential ellipsis in [$\mathsf{td2}$-$\mathsf{td3}$] and [$\mathsf{td4}$-$\mathsf{td5}$] and a space of the story that changes from $wr1$ to $wr2$ and then $wr3$. The space (total) of the macro event $e1$-$e6$ is constituted by the union of three spaces of events: $wr1 \cup wr2 \cup wr3$. For every pair of contiguous events it is valid the condition 7.2.2.

The conditions given in 7.2.2, 7.2.4, 7.2.5, 7.2.6, 7.2.7, and 7.2.8 can be used also to define the end (the break) of a macro event, as follows:

$$\begin{array}{l} \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{break}(\mathsf{Ex}, \mathsf{Ey}))) \leftarrow \\ \ \mathsf{not}\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{noBreak}(\mathsf{Ex}, \mathsf{Ey}))). \end{array} \quad (7.2.11)$$

In figure 7.2.2 I give an example of macro event $e2$-$e6$ present in the movie *The Burning Plain* [TheBurningPlain], in which there are two breaks. In such segment of movie there are, both a change of the space in which the events happen, and a change of the characters that participate to these events in which the condition $\mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{Spx}, \mathsf{sameMacrE}(\mathsf{E1}, \mathsf{E2}))$, expressed by the 7.2.2, has been respected. In the movie segment taken in consideration, Mariana says to Santiago to be pregnant. In the narration follows the event $e2$,

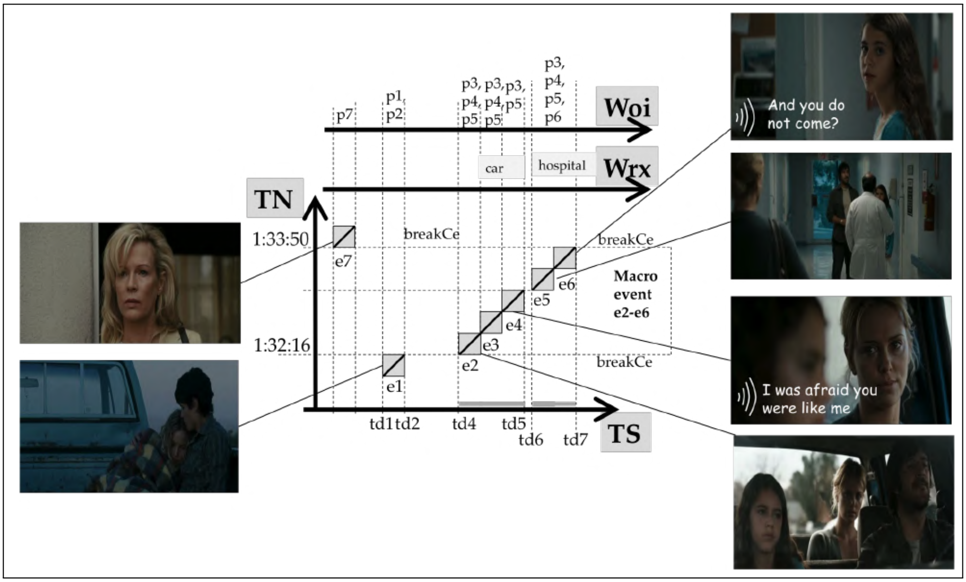


Figure 7.2.2: A macro event in *The Burning Plain*

in which there is a break of the story – in which there is a change of characters and place – the story passes with discontinuity, from the dialogue scene between the young Mariana and Santiago[8], in a car outside of an hospital. In this passage, being the events visually contiguous, neither one of the condition 5, 6, and 7 present in 7.2.2 is respected – in such way it occurs a break in the story.

The macro event $e2$-$e5$ begins with Sylvia, Maria and a friend of Santiago who are in the car (event $e2$). The friend exits from the car to allow Sylvia and Maria to speak freely (the event $e3$ it is not very important in this analysis, for this reason I haven't reported the still image in the figure). In $e4$ Sylvia confesses to Maria the reason why he had abandoned her when she was a baby "I was afraid you were as me" he says. Then there is an intra-sequential ellipsis between $\mathtt{td5}$ and $\mathtt{td6}$. This passage doesn't involve a change of macro event, as there is causality between the events $e4$ and $e5$ (the condition 7.2.2 is respected). The story in the hospital regards the event $e5$, in which a doctor says to Maria that Santiago will heal. Always in the hospital Maria invites

8 we remember that in the story in *Burning Plain* Mariana is Sylvia when she was a child and that Maria is the daughter born from the intercourse between Mariana and Santiago

($e6$) her mother Sylvia ("Don't you come?") to go into the hospital room in which there is the father.

After the event $e6$ there is a break of the macro event $e2$-$e6$ as for the event $e7$, no one of the conditions 5, 6 e 7 is respected, in fact it is shown Sylvia's mother in a spatial and temporal context totally different from the one of the macro event $e2$-$e6$.

7.3 AGGREGATIONS OF MACRO EVENTS AND PARTIAL STORIES

A macro event constitutes a part of a telling that, by a cognitive point of view, contains a unitary aggregation of events. For this reason, we can affirm that a macro event is one of the base components of a partial story. Every construction of a story[9] has a genesis starting from the creation of a macro event or an existing partial story. Two macro events or two partial stories (a macro event or a partial story) aggregate themselves through a deixis. Every deictic temporal inferences that occurs between two events aggregates stories – although there are also various no temporal deixis that aggregate macro events and partial stories. The conditions for the two events $E1$ and $E2$ to belong to a same story Stx are less restrictive than to the belonging of $E1$ and $E2$ to a same macro event. The belonging of events to an only story entails the existence of at least a deiptic relation between $E1$ and $E2$, in which these latter can belong also to different partial stories $St1$, $St2$. A partial story then can be composed too by flashbacks, narrative ellipsis or other forms of break.

The easier aggregation of partial stories occurs when the spectator believes that a determined character $P2$, participating in an event $E2$ of a macro event

9 Often, the term "story" is used when we speak about the movie in its entirety, where we use locutions of the kind "the story is", "the story deals with", "the story is set in" and so on. We use this expressions after that we have seen the whole movie and we dealt with the movie in its totality – as a whole having specific *meta qualities*. In this chapter I use the term *story* to denotate the movie as totality and of "partial story" as events aggregation, macro events or partial stories that are part of the entire movie story.
Formally a partial story is defined recursively as follows:

partial story	:= a macro event	or
	:= aggregation of two partial stories	

or of a partial story, is the same character $\mathsf{P1}$, participating in an event $\mathsf{E1}$ of another macro event or partial story ($\mathsf{bel(Spx, same(P1, P2))}$). The formal inference for this cognitive rule is the following: Spx believes that $\mathsf{E1}$ and $\mathsf{E2}$ belong to the story Stx if $\mathsf{P1}$ takes part to the event $\mathsf{E1}$; $\mathsf{P2}$ takes part to the event $\mathsf{E2}$; $\mathsf{E1}$ belongs to the story $\mathsf{St1}$; $\mathsf{E2}$ belongs to the story $\mathsf{St2}$; $\mathsf{P1}$ and $\mathsf{P2}$ are the same characters.

$$
\begin{array}{l}
\mathsf{mev(Tx, bel(Spx, sameStory(Stx, E1, E2)))} \leftarrow \\
\ 1\ \ \mathsf{mev(Tx, bel(Spx, who(E1, P1)))}, \\
\ 2\ \ \mathsf{mev(Tx, bel(Spx, who(E2, P2)))}, \\
\ 3\ \ \mathsf{mev(Tx, bel(Spx, storyE(St1, E1)))}, \\
\ 4\ \ \mathsf{mev(Tx, bel(Spx, storyE(St2, E2)))}, \\
\ 5\ \ \mathsf{mev(Tx, bel(Spx, sameP(P1, P2)))}, \\
\ 6\ \ \mathsf{newStory(Spx, St1, St2, Stx)}, \\
\ 7\ \ \mathsf{story(Stx)}.
\end{array}
\tag{7.3.1}
$$

The inference 7.3.1 not imply that are the beliefs 3 and 4 are eliminated. This entails that $\mathsf{E1}$ and $\mathsf{E2}$ even if belonging to the new partial story Spx continue to belong also to their initial respective stories $\mathsf{St1}$, $\mathsf{St2}$. The model of construction of a story foresees that every event can belong to different partial stories – through this process of aggregation at the end of the telling every event will belong to the whole story and to all the partial stories of which it has taken part.

When the spectator Spx to the conditions of the inference 7.3.1 also add that the events $\mathsf{E1}$ and $\mathsf{E2}$ belong to two different macro events then Spx believes that a deixis occurs in the story.

Generally every kind deixis $\mathsf{bel(Spx, deixis(E1, E2))}$ (temporal or not temporal) generates a new story, that is constituted by the union of the two partial stories of which $\mathsf{E1}$ and $\mathsf{E2}$ were part. After every new story generated by the existence of a deixis, we need to generate a new name or symbol of the story – in the 7.3.1 I have indicated this operation of the spectator with the expression $\mathsf{newStory(Spx, St1, St2, Stx)}$.

I need to add that the formalism given proposes a same symbol Stx for the two stories that aggregate themselves – in the fusion of two stories then you have to take into account also the generation of a new name (eventually in the epithet form). This activity is performed by the viewer who often creates the names of the stories by using the names (also them epithets) of the same characters. For this reason, if in a story Stx there is a character named “maria”, the name of the story generated is the epithet ”Maria’s story” and if in another story Sty the name of the character is the epithet ”the man with the bear”, the story Sty could take the name of ”the story of the man with the bear” – in the end the spectator who has to chose a name of the story that aggregates Stx and Sty – will probably call it ”the story of Maria and of the bearded man”[10].

I won’t go on the genesis of names of the partial stories, but about what are the mechanisms of aggregation among them. The movie *360*[11] is a very good example of story, in which different macro events and partial stories are aggregated by deixis that generate themselves through characters’ properties – $friend(P1, P2)$, $lover(P1, P2)$, $husband(P1, P2)$, $wife(P1, P2)$, and so on.

I comment some passages for the aggregation genesis of the partial story in *360*, in the beginning phase of the movie (see figure 7.3.1). In the macro event relating to the partial story $St1$ there are various events that for the fact itself to belong to a same macro event constitute a partial story. In these macro events there are relations ($r1$, $r2$, $r3$) among characters, that don’t constitute deixis having a characteristic of inter-storical relation. Before the presentation of the macro event $mv4$ and of the correspondent story $St4$ (see figure 7.3.1), the spectator doesn’t possess sufficient knowledge to effectuate aggregations. After $St4$, in particular after that the spectator acquires in his cognitive state the belief that *Michael Dely is Rose’s husband* ($r6$), he generates a deixis with the macro event mv1 of the story $st1$, in which spx has seen for the first time Michel Daly as potential client of Blanca (the escort). In $mv4$ another deixis is generated – the one activated by the presence of Rose – the woman the spectator has followed in the story $st3$ of the macro event $mv3$.

In a schematic form, the genesis of the spectator’s cognitive states for the aggregation of the story events, happens through the following steps:

1. Every macro event Mev is a partial story Stx;
2. If two visually contiguous events $E1$ and $E2$ cause a break then a new macro event is generated (a new partial story is generated);

---

10 To my knowledge there are no studies about an automatic name generation mechanism of stories, partial stories or episodes. It would be interesting to undertake to take one. In my lines I have given only a qualitative description of the composition mechanism.

11 *360* [360] is a movie directed by Fernando Meirelles, Rachel Weisz, Jude Law and Anthony Hopkins as protagonists.

Figure 7.3.1: Aggregations of the macro events and partial stories in *Passions and Desires*

3. If two events $E1$ and $E2$ belong to two partial stories St1, St2 and it occurs a deixis between $E1$ and $E2$ ($bel(Spx, deixis(E1, E2))$), then all the events of the story $St1$ and those of the $St2$ belong to a new partial story Stx ($Stx = St1 \cup St2$)

I present a procedure – general enough for the aggregation of partial stories – applying the scheme just presented. In the formulation of the procedure I have supposed that after every act of vision, there is an acquisition of spectator's belief relative only to one diegetic event. The algorithm works comparing in every step two acts of vision S_i e S_{i+1}, having two indexes M and N:
- M is used both as index of the beginning vision time T_M, and as index of the beginning time of the diegetic interval Td_M of the first act of vision S_i;
- M_{i+1} is used both as index of the ending time vision T_{M+1}, and as index of the ending time of the diegetic interval Td_{M+1} of the first act of vision S_i;
- N is used both as temporal index of the beginning of vision T_N, and as index of the beginning time of the diegetic interval Td_N of the second act of vision S_{i+1};
- N_{i+1} is used both as index of the ending time of vision T_{N+1}, and as index of the final time of the diegetic interval Td_{N+1} of the second act of vision S_{i+1}

$M \leftarrow 1$ % M is the first temporal index - set to 1.
$S \leftarrow 1$ % S is the first index of vision act - set to 1.
$V_S \leftarrow$
$visAct([T_M, T_{M+1}], Spx, Seg_M, [Td_M, Td_{M+1}], E_M)$ % Assignment of the current vision act to V_S.
$Seg_M \leftarrow FilmicSeg(V_S)$
$T_M \leftarrow InitVisionTime(V_S)$
$T_{M+1} \leftarrow EndVisionTime(V_S)$
$E_M \leftarrow DiegeticEv(V_S)$
$Td_M \leftarrow InitDiegEvTime(V_S)$
$Td_{M+1} \leftarrow EndDiegEvTime(V_S)$
$X \leftarrow 1$ % X is the index of the stories - set to 1.
$I \leftarrow 1$ % I is the index of the macro events - set to 1.
$mev(T_{M+1}, bel(Spx, Mce_I(E_M))$ % E_M belongs to macro event Mce_I.
$mev(T_{M+1}, bel(Spx, St_X(E_M))$ % E_M belongs to the story St_X.
$S \leftarrow 2$ % S is the second index of the vision act (set to 2)
$N \leftarrow 3$ % N - is the second temporal (set to 3)
% S and N are indices used for the comparison.

$V_S \leftarrow$
$visAct([T_N, T_{N+1}], Spx, Seg_N, [Td_N, Td_{N+1}], E_N)$ % Assignment of the current vision act to V_S
WHILE $V_S \neq nil$ % There are other visual acts to be analyzed.
$Seg_N \leftarrow FilmicSeg(V_S)$
$T_N \leftarrow InitVisionTime(V_S)$
$T_{N+1} \leftarrow EndVisionTime(V_S)$
$E_N \leftarrow DiegeticEv(V_S)$
$Td_N \leftarrow InitDiegEvTime(V_S)$
$Td_{N+1} \leftarrow EndDiegEvTime(V_S)$
IF % If the events
$mev(T_{N+1}, bel(Spx, visContiguous(E_N, E_M))),$ % E_N and E_M are contiguous,
$mev(T_{N+1}, bel(Spx, cause(E_N, E_M)));$ % E_N causes the event E_M, or
$mev(T_{N+1}, bel(Spx, nocut([T_N, T_{N+1}])))$; % in $[T_N, T_{N+1}]$ there are no cuts, or
$mev(T_{N+1}, bel(Spx, meets(E1, E2)))$; % Spx believes that E1 meets E2, or
$mev(T_{N+1}, bel(Spx, conPrassi(E_N, E_M)))$ % E_M follows by E_N for the praxis rule inference
THEN % of praxis between the two events.
$mev(T_{N+1}, bel(Spx, Mce_I(E_N)))$ % Mce_I is the macro event also of E_N.
$mev(T_{N+1}, bel(Spx, St_M(E_N)))$ % St_M is the story also of E_N.

```
ELSE
mev(T_{N+1}, bel(Spx, break(E_M, E_N)))          % There is a break in the story.
I ← I + 1                                        % There is a new macro event in the telling.
mev(T_{N+1}, bel(Spx, Mce_I(E_N)))               % E_N belongs to the macro event Mce_I
X ← X + 1                                        % These is a new partial St_X in the telling
mev(T_{N+1}, bel(Spx, St_X(E_N)))                % E_N belongs to St_X
ENDIF
List ← FindDeixis(Tx, E_N, List)                 % Finds and inserts in the List each event
                                                 % with which E_N has a deixis.

WHILE List ≠ nil
E_V ← First_element of List
X ← X + 1                                        % X + 1 is the index of the new partial story St_X
mev(T_{N+1}, bel(Spx, St_X(E_V)))
mev(T_{N+1}, bel(Spx, St_X(E_N)))
List ← List − E_V
ENDWHILE
S ← S + 1                                        % S is the index of new vision act.
M ← N                                            % M takes the value of last temporal index,
N ← N + 2                                        % N is the index of the second
                                                 % temporal vision act of comparison.

V_S ←
visAct([T_N, T_{N+1}], Spx, Seg_N, [Td_N, Td_{N+1}], E_N)    % Assignment of the current vision act to V_S.
ENDWHILE
```

```
PROCEDURE FindDeixis(Tx, Ex, List)
findall(Ey, mev(Tx, bel(Spx, deixis(Ex, Ey), L)))[12]
END PROCEDURE
```

7.4 FRAGMENTATION OF THE STORY

In this paragraph I introduce a method for measuring an aspect which is becoming increasingly important in contemporary cinematography – the fragmentation of a story. Notion that is often used in a no formal meaning[13],

12 The procedure is a rewriting, in the pseudo code I are adopting, of predicate $\mathrm{findall}(X, F(X, \_), L)$ – primitive of the logic programming Prolog. An example of application of this primitive is the following:
– facts Prolog $g(c, 1)$; $g(a, 4)$; $g(f, 5)$; $g(b, 3)$.
– call from the predicate $\mathrm{findall}(X, g(X, \_), L)$.
– solution $L = [c, a, f, b]$.

13 In the context of movie analysis with complex plot, some researchers and theorists have introduced the term fragmentation. In particular in [Ghislotti2011] - p. 233, regarding this, is given a qualitative definition:

> about "fragmentation" I mean the frequent and sudden interruption of the presentation of the facts, to show events happened previously or subsequently or in other places or worlds, ...

in stories analysis with high complexity of plot. I retain that the fragmentation, for the analysis of the global structures of a story[14], is a concept that can be represented through three main components: the number of discontinuity present in the story, the number of suspensions of the story (number of hypothetical ellipsis), and wideness of inference.

The three notions are presented in this section.

STORY DISCONTINUITY. A story (or a story segment) is discontinuous if in it (or in a part of it) exists a flashback (flashforward) or a narrative ellipsis. In almost all the movies, every kind of break of the story is linked at the end of the telling, manifesting its discontinuous character, only during its developing. Every kind of discontinuity can be individuated when occurs a break of a macro event that presents itself between two events visually contiguous in a narration. A break has been defined in 7.2 by a cognitive point of view ($\mathsf{bel}(\mathsf{Spx}, \mathsf{breakMe}(\mathsf{E1}, \mathsf{E2}))$) – for this reason an interruption of the story doesn't regard the simple interruption of a shot, but the belief of the spectator about a group of story events. I won't take into account the absolute number of interruption in a story, but the ratio among the number of breaks present in the whole story and the total time of the telling, I will call **Density of the discontinuities** (DD) of a story:

$$\text{Density of the discontinuities} = \frac{\text{Number of breaks in the story}}{\text{Total time of telling}} \tag{7.4.1}$$

In figure 7.4.1 it is given a diagram representing a metric of the cognitive break of a story, in particular the metric of movie *Pulp Fiction*.

14 This typology of analysis has a natural comparison with a recent research named Cinemetrics ([Cinemetrics2014], [Elsaesser2002], pp. 101-16). In these studies I quote, are taken into account some measures based on the entity *shot* – intended as a unity in which there aren't cuts or others interruptions of the scene. These measures in *Cinemetrics* regard the duration of the shots and their medium length, the movements of the camera, the shots angles and the spatial-temporal movements between contigue frames. The different approach for the metrical analysis between my approach and those given in Cinemetrics, consist in the fact that the metrics I propose are based on semantic-cognitive entities of analysis, while those considered in Cinemetrics defined through on markers of syntactic nature – this latter are in a way independent from the content of the events of the story and from the spectator's inferential processes.

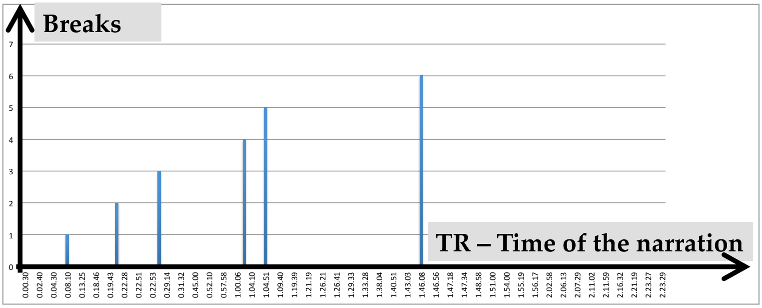


Figure 7.4.1: The metrics of the breaks for the film *Pulp Fiction*

SUSPENSIONS. Another element contributing to the measure of fragmentation is due to the events that, for a certain period of time, have not been temporally anchored on the axis of the story. This phenomenon is present in the telling when in the story an event happens and the spectator hasn't sufficient knowledge (until that moment of the narration) to anchor the event on the temporal axis of the story – in other words when occurs an hypothetical ellipsis (see paragraph 3.6). The calculus of the events number (number of suspensions) that have undergone a suspension in the process of anchoring, starts from the first macro event of the telling and increases every time that:

1. An event $E2$ is shown in the story generating a break that is not linked by deixis to any event present in the story (I call $E2$ the event pivot of a suspension);
2. An event $E2$ is shown in the story belonging to a macro event in which a pivot event exists, as defined at the previous point;
3. A break occurs, and the event $E2$ which has provoked it possesses a deixis with another event Ex belonging to a macro event in which there is a pivot event

In this way, the number of suspensions is determined by the number of hypothetical ellipsis and the events that to these ellipsis are aggregated. I formulate a measure of **density of the suspensions** (DS) present in a story, as the number of suspensions present in the whole story, divided for the total time of the telling:

$$\text{Density of the suspensions} = \frac{\text{Number of suspensions}}{\text{Total time of telling}} \tag{7.4.2}$$

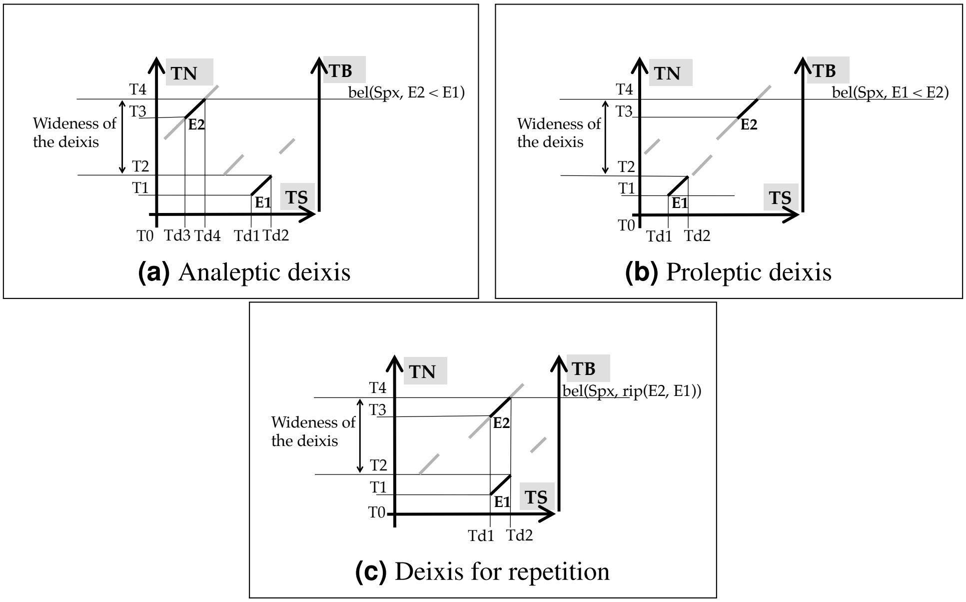
The number of hypothetic ellipsis present in a story, then, contributes to the fragmentation of a story. Generally the hypothetical ellipsis are greater at the beginning of the movie (there is a bigger density of suspensions) – the more the telling goes on, the more difficult is the presence of ellipsis. The movie stories do not introduce towards the end of the telling new hypothetic ellipsis, as in this phase the narrative strategical effort is aimed at eliminating all interruptions present in the story.

WIDENESS OF THE DEIXIS INFERENCES. I introduce a concept in which we can associate a measure resulting useful to measure of fragmentation of a story: the wideness of the inference of the temporal anchoring. The cognitive rules until here introduced, have been always formulated according to two events: Ex (evoking event) and Ey (evoked event) – for this reason for every temporal anchoring it is possible to define a **wideness of deixis**, measured as the distance on the axes TN of the telling (and by consequence on the mental axes TM), between the temporal instant in which the evoking event Ex has been presented in the narration and the temporal instant in which the correspondent evoked event Ey has been presented – I indicate this temporal interval as $\mathsf{WD}(\mathsf{Ex}, \mathsf{Ey})$.

The wideness of the deixis constitutes the measure of how are chronological far in the telling two events involved in the deictic inference. Being the axis TR in correspondence with the mental time TM, the wideness of inferences gives a measure of the spectator's cognitive cost in applying a determined inference – as more the events are far in the time of narration, bigger is the spectator's effort of remembering, considering also the action of *opposition* to the remembering caused by probable of other story events that have been shown in the narration between the time of presentation of the evoking event Ex and the one of the evoked event Ey.

In figure 7.4.2 I give some examples of wideness inference, concerning three main temporal deixis: analeptic, proleptic and for repetition (deixis defined in the paragraph 5).

I note that the wideness of deixis $\mathsf{WD}(\mathsf{Ex}, \mathsf{Ey})$ is a parameter that can be measured objectively by a timer. In addition to the wideness of deixis $\mathsf{WD}(\mathsf{Ex}, \mathsf{Ey})$, I have to consider the domino effect relative to the action *of dragging* of the events to which Ey was linked. This effect can be represented through the repertoire of cognitive rules described in 2.11.2, in particular us-



(a) Analeptic deixis

(b) Proleptic deixis

(c) Deixis for repetition

Figure 7.4.2: Wideness of deixis

ing the rule of the transitivity of temporal relations[15]. I propose so a measure that considers also the domino effect. I define an entity – that I call inference cost ICOST – as the product of the wideness of deixis $WD(\mathsf{Ex}, \mathsf{Ey})$ (with Ex the evoking event and Ey the evoked event) for the number of events $\mathsf{N}ev(\mathsf{Ey})$ temporal connected to Ey:

$$\mathsf{ICOST} = WD(\mathsf{Ex}, \mathsf{Ey}) \, * \, \mathsf{N}ev(\mathsf{Ey})$$

At the end of the telling, in *Pulp Fiction* occurs a deixis for repetition of events – in correspondence of the event Ex showing a young man in a bar pointing a gun against customers. The event evoked Ey is temporarily placed on the axis of the narration. The event Ey being temporally connected to other

15 The dragging phenomenon occurs because when the viewer identifies a deixis between events, in addition to anchor a event Ex that triggered the deixis, we must also anchor all the events that have some time relationship with Ex – the application of the rule of transitivity for relations of temporal order ($\mathtt{prec}(\mathsf{E1}, \mathsf{E2}) \wedge \mathtt{prec}(\mathsf{E2}, \mathsf{E3}) \Rightarrow \mathtt{prec}(\mathsf{E1}, \mathsf{E3})$ allows to identify all the events that have a temporal relationship with Ex and even those that are indirectly connected with Ex.

events E_j (the events belonging to the macro events of Ey), activates a domino effect of dragging for all the events E_j.

Also for the inference cost we consider a measure in terms of density (**Density of Inferences Cost** (DIC)) defined as the sum of the inferences cost, inherent to each deixis, divided the time of the telling:

$$DIC = \frac{\sum_{i=1}^{n} ICOST_i}{Total\ time\ of\ telling}$$

DEGREE OF FRAGMENTATION OF THE STORIES. I conclude this section by reporting a method to compare the fragmentation of more stories. For this end we consider the grade of fragmentation (Fr) of a story as a function f having three parameters: the density of the discontinuities DD, the density of the suspensions DS and the density of the inferences cost (DIC):

$$Fr = f(DD, DS, DIC) \tag{7.4.3}$$

To execute comparisons of fragmentation among two or more stories, we represent the fragmentation of each single story through the area of a triangle in the diagram having the axes DD, DS and DIC (see figure 7.4.3). Then we superimpose all representing area individual stories in a single diagram DD-DS-DIC. As application of the method introduced, I have performed a comparison among the following stories: *Pulp Fiction*, *The English Patient* [TheEnglishPatient] and *Memento*[16]. In figure 7.4.3 is given the comparison.

1. *Memento* is the story that has the biggest grade of fragmentation – it has a biggest density of discontinuities and suspensions;
2. *Pulp Fiction* has a greatest density of inference cost, this was predictable as there is a deixis of great wideness in the telling between two events – the one of the robbery and its repetition. Such events are very distant between them on the axis of narration TN;
3. *The English Patient* has a remarkable density of discontinuity, due to the fact that are many flashbacks in the telling

16 The complete annotations of each story are given in 11. The fragmentation measurements of the *Pulp Fiction*, *Memento* and *The English Patient* stories were performed by Gianluca Coda and Paolo Vanacore.

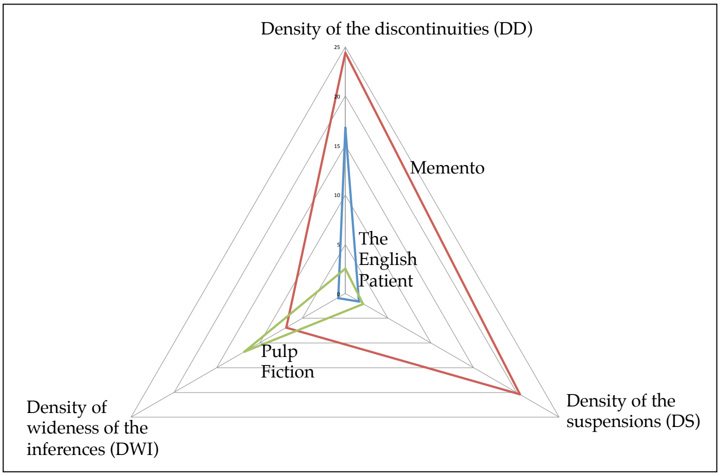


Figure 7.4.3: Comparison of fragmentations among *Pulp Fiction*, *Memento* and *The English Patient*

A COMPARISON WITH ANOTHER THEORIES. Y. Mouren is author of a method for the classification of flashbacks — the researcher has proposed a theory that uses four structural attributes [Mouren2005]: the scope, the wideness, the fitting and the continuity. G. Genette, previously, introduced in the literary narrative, two concepts: the scope and the wideness. Obviously, his interest was about the anachrony (corresponding to the cinematographic notion of flashback) – a figure shifting the story more or less far from the "present" (the point of the story in which the telling interrupt itself) – this temporal distance was called by him scope of the anachrony.

The anachrony according to G. Genette, can cover a part more or less wide (wideness) of the story. In [Mouren2005] Y. Mouren *rewrites*, in the cinematographic context, G. Genette's theory. Firstly by substituting the anachrony with the term flashback (more adequate to the filmic context) and re-defines the wideness concept. It is because there are, Y. Mouren affirms, big difficulties to measure the wideness on the temporal axis of the story, often for the absence of diegetic temporal indexes. Y. Mouren's proposal regarding the wideness concept of a flashback is the following:

> the amount of the number of happenings contained in the part of the movie interesting the going back of the story, in relation to the totality of the actions and situations of the story

Y. Mouren adds to her flashback model the completive fitting (or not completive) and the continuity (discontinuity)[17]. Y. Mouren's model is not applicable to the context of contemporary cinematography, where the flashbacks aren't identifiable in a net way, as it happened in the classic cinematography, where the flashbacks end in a completive manner[18].

The recent kinds of flashbacks, especially the narrative ones that uses only images, are preceded by sophisticated deixis, and often they are not completive (don't go back into the present), or have not in the present time of the story a specific narrative reference, as happens in many storie of puzzle films (but also in stories not classified as puzzle, as for example the *The Human Stain*[19]).In these categories of narrations doesn't exist a clear notion of present time – the telling often starts with some partial stories, that in a first part of the narration are not linked, that merge themselves at the end of the telling in an only story.

Also after the rewriting operated by Y. Mouren, the wideness and the scope of a flashback, they are (or "they are inherent to") entities collocated on the story axis with a high density of elements to represent. Furthermore if we consider the expression contained in Mouren's definition "in relation to the totality of the actions and situations of the story" we can note that it is not mentioned what is the process of an identification of actions and situations to measure the "totality" of story which it is alluded in the definition.

Also after the rewriting operated by Y. Mouren, the wideness and the scope of a flashback remain difficult to measure – they are entities, collocated on the story axis, with a high density of elements to be represented. Furthermore if we consider the expression contained in Mouren's definition "in relation to the totality of the actions and situations of the story" we can note that it is not mentioned what is the identification process of actions and situations to

---

17 Continuity (or discontinuity) is a concept concerning the way in which the past events are linked to the current happenings of the story. Mouren's notion of continuity is similar to my concept of linearity introduced in 7.1. The main difference between my model and that of Mouren exist on the way of understanding the flashback: my definition involves two visually contiguous events, while that of Mouren more events belonging to part of story that plays the role of "fitting" beetwen past and present of the story.

18 [Mouren2005] p. 9

19 *The Human Stain*. [TheHumanStain], a movie directed by Robert Benton and with Antony Hopkins and Nicole Kidman is an example of movie that even if is not classified as puzzle film, is not completive.

measure the "totality" of story to which it is alluded. In the end respecting

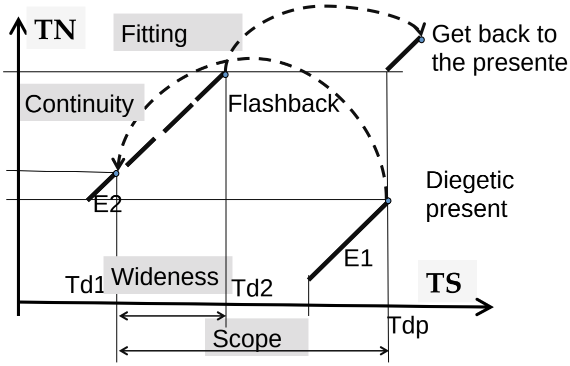


Figure 7.4.4: Flashback model of Genette-Mouren in the plan TN-TS

to the approach until here given, Y. Mouren proposes a notion of flashback involving also the modality of the linking of past story events with events of present time (the fitting). In my view, this methodological choice increases unnecessarily the difficulties of representing the flashbacks. As shown in the chapter 4, the flashbacks have a structure that can be represented in a local way – without involving wide parts of the story – this allows the represention of the narrative models, for those stories in which the fitting of the break can be also complex or can't exist at all.

7.5 STORIES NOT LINEAR WITH EXPLICIT TIME OF REFERENCE

There are movies presenting deixis that use some explicit temporal utterances inside of the filmic text. Such deixis allow the spectator to construct beliefs on events, sufficient to distinguish a break in the story, a flashback or a flash-forward as described in the paragraph 4.4.2. These movies often maintain an homogeneous style of explicit temporal utterance for the whole telling. Of course there are movies with a variable style of temporal jumps, just as *Robin Hood* by Rydle Scott, that starts from captions containing temporal indications and continues abandoning such style of narration.

An example of movie maintaining, in a homogeneous manner the style of explicit temporal utterances in all the telling, is *The Killing* by S. Kubrick. In the film every temporal jump is realized through an extradiegetic voice that utters explicitly – in qualitative or chronologic manner – a temporal relation or an chronological temporal expression. The same homogeneity of explicit utterance for the temporal change is present in *Before the Devil Knows You're Dead*[20], although in this movie the interruptions, as any action of fitting, differently from *The killing*, are expressed through captions. The use of captions, or of extradiegetic voice, are techniques impacting not only on the narrative style, but also on the inference type that the spectator adopts to effectuate the correspondent temporal anchoring.

In the paragraph 4.4 I have considered a model of reasoning where the spectator associates a time of reference to the events. I believe that the spectator, in his inferences of temporal reasoning, associates a time of reference also to macro events. I consider the starting time of the first event of the macro event the reference time characterizing the macro event itself.

For example in the sequence with events $E_i(i = 1, n)$ visually contiguous, the starting time of E_i is the reference time of macro event. If an extradiegetic voice at the beginning of the macro event Ei declares that the day is 11th of September and that to the end of the macro event Ei the same voice utters a sentence of the kind "two days after" or "four days before", the spectator considers the reference time of the macro event the date "11th of September".

From the example reported, it necessary to introduce a notion of time of the happening, time of reference, and time of enunciation, for an entire macro event. Formally:

$bel(Spx, ta(Mcex, TaMcex))$
% $TaMex$ is the time of happening of macro event $Mcex$

$bel(Spx, tr(Mcex, TrMcex))$
% $TrMcex$ is the time of reference of macro event $Mcex$

$bel(Spx, te(Mcex, TeMcex))$
% $TrMcex$ is the time of enunciation of macro event $Mcex$

20 The movie *Before the Devil Knows You're Dead* [BeforeDevilKnows] has been directed by Sidney Lumet, starring Philip Seymour Hoffman e Ethan Hawke

where $Mcex = E1\text{-}En$ is a macro event formed by the sequence of $E1$, $E2$, .. En ($E1\text{-}En$), $TaMcex$, $TrMcex$, and, $TeMcex$ in the expressions given are respectively the event time, the reference time, and the enunciation time of the first diegetic event $E1$ present in the sequence of the macro event $Mcex$. I take the first event of the sequence of the events of the macro event as representative of the happening of a macro event $Mcex$. With these choices we are able to rewrite for a macro event the inference defined for the diegetic events (presented in 4.5.3) containing an explicit chronological time. The inference rule is the following. Spx believes that $E2$ is a flashforward of $E1$ if Spx believes that: $Mce1$ is visually contigue to macro event $Mce2$; $E1$ is the first event of macro event $Mce1$; $E2$ is the first event of macro event $Mce2$; $E1$ and $E2$ belong to the same story; $TaE1$ is the time of happening of $E1$; $TaE2$ is the time of happening of $E2$; and $TaE1$ precedes $TaE2$. Formally:

$$
\begin{aligned}
&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{flashforward}(E2, E1))) \leftarrow \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{visContigue}(Mce1, Mce2)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{first}(E1, Mce1)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{first}(E2, Mce2)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{sameStory}(Str, E1, E2))), \mathit{story}(Str), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{ta}(E1, TaE1)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{ta}(E2, TaE2)), \\
&\quad \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{prec}(TaE1, TaE2))).
\end{aligned}
\tag{7.5.1}
$$

Also it holds:

Spx believes that $E2$ is a flashback of $E1$ if Spx believes that: $Mce1$ is visually contigous to macro event $Mce2$; $E1$ is the first event of the macro event $Mce1$; $E2$ is the first event of the macro event $Mce2$; $E1$ and $E2$ belong to the same story; $\mathsf{TaE1}$ is the time of happening of $\mathsf{E1}$; $\mathsf{TaE2}$ is the time of happening of $\mathsf{E2}$; and $\mathsf{TaE2}$ precedes $\mathsf{TaE1}$. In a formal way:

$$\begin{aligned}
&\mathsf{mev(Tx, bel(Spx, flashback(E2, E1)))} \leftarrow \\
&\quad \mathsf{mev(Tx, bel(Spx, visContigue(Mce1, Mce2)))}, \\
&\quad \mathsf{mev(Tx, bel(Spx, first(E1, Mce1)))}, \\
&\quad \mathsf{mev(Tx, bel(Spx, first(E2, Mce2)))}, \\
&\quad \mathsf{mev(Tx, bel(Spx, sameStory(Str, E1, E2))), story(Str)}, \\
&\quad \mathsf{mev(Tx, bel(Spx, ta(E1, TaE1)))}, \\
&\quad \mathsf{mev(Tx, bel(Spx, ta(E2, TaE2)))}, \\
&\quad \mathsf{mev(Tx, bel(Spx, prec(TaE2, TaE1)))}.
\end{aligned} \tag{7.5.2}$$

In the case the beliefs $\mathsf{bel(Spx, prec(TaE2, TaE1))}$ (reported in 7.5.2) and $\mathsf{bel(Spx, prec(TaE1, TaE2))}$ (reported in7.5.1) can be easily determined by the spectator as the terms $\mathsf{TaE2}$ and $\mathsf{TaE1}$ are expressed according to the time of reference (time that can be determined through the inferences introduced in 4.4) that are explicitly uttered in the story through extradiegetic voice or captions. The spectator so, has only to perform a comparison among temporal terms to establish if the figure is a flashback or a flashforward. As example of a non linear story segment with time of explicit reference, I take into account the first four utterances of the extradiegetic voice, present in the movie *The Killing*:

1. At 3:45 pm of that Saturday afternoon of the last week of September
2. An hour earlier the same Saturday afternoon
3. At 7 on the same afternoon in September
4. Half an hour earlier at half past six

I analyze the inferences that have been activated by the spectator to reach the temporal anchoring shown in figure 7.5.1. After the utterance 1- of the extradiegetic voice, the spectator assumes the time of the happening equal to the one of reference in which is enunciated the verbal expression "the Saturday afternoon of the first week of September" – the rule of inference applied is the 7.5.1 given in the paragraph 4.4.2. After the utterance 2, the spectator performs another temporal anchoring – it is a flashback occurring for the application of the inference 7.5.2. The spectator arrives to the conditions $\mathsf{mev(Tx, bel(Spx, prec(TaE1, TaE2)))}$ of 7.5.2, for the verbal ex-

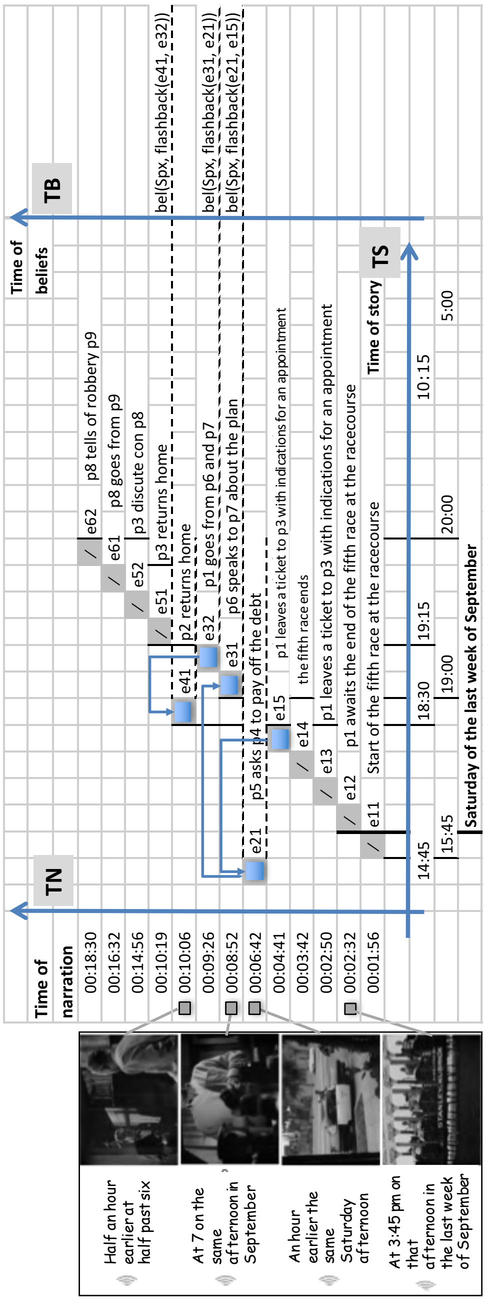


Figure 7.5.1: Explicit reference time through extradiegetic voice in *The Killing*

pression of the extradiegetic voice that uses the adverbial ”before” by applying the inference 4.5.19 given in 4.4.2. After the utterance 3, the spectator performs a temporal anchoring – it deals with a flashforward occurring for the application of the inference 7.5.1. The spectator acquires the time of reference through the 4.5.20 of the paragraph 4.4.2, and the condition $mev(Tx, bel(Spx, prec(TaE1, TaE2)))$ performing a comparison between happenings of the contiguous events $E1$ and $E2$.

After the utterance 4, the spectator performs an anchoring (flashback) to activate the rule 7.5.2, in which the $mev(Tx, bel(Spx, prec(TaE1, TaE2)))$ condition is acquired again by the adverbial ”half an hour before” through the 4.5.19.

7.6 STORIES WITHOUT EXPLICIT TEMPORAL ENUNCIATIONS

There are movies stories whose narrative structure is formed in prevalence by narrative flashbacks – non linear stories – in which there aren’t extradiegetic voices or captions. These narrative forms ask the spectator to activate complex inferences to anchor the events. This is due to the fact that an external flashback not having time of reference, nor utterances that contain temporal relations, requires the activation of additional inferences (deixis) that are activated considering two visually contiguous events (local deixis). To this category also belong the flashbacks having some delay in the activation. An example of local deixis is that involving the age of the characters (formally represented by 5.6.2 in the paragraph 5.6), that expresses the rule that the event in which a character is young, always precedes the event in which the same character is old. These deixis rigidly impose a temporal order on the events, and force the spectator to anchor the events in this way.

Many movies of the classic cinema have a structure constituted by few flashbacks of big wideness and scope, while in a cinema contemporary context, flashbacks have reduced the wideness and the scope, and present an high number of discontinuity due to the presence of numerous breaks of the story. For example *English Patient* that is considered as a classical movie by a structural point of view, contains a smaller number of narrative flashbacks of more recent *The Human Stain*.

In contemporary movies, there is not only a tendency to increment in the number of flashbacks, but also to adopt in the narrative structure different typologies of flashbacks. A movie that possesses these characteristics is *Incendies*. In this movie there are internal flashbacks for remembrance, external flashbacks and some flashbacks using captions. This latter use names of places or characters to build temporal inferences (anchoring). I refer to those diegetic situations when a character says he will go to a determined place, and after in the telling is shown such character in that place, or when it is shown, at the beginning of an episode, a caption indicating the name of a character Px in which in the narration has already been reported that Px has lived in a past time.

7.7 STORIES WITH HYPOTETICAL ELLIPSES

There are stories of movies where the dominant figure of the narration used is the hypothetical ellipsis. Such figures presenting pending events waiting to have a collocation on the axis of the story (for the lack of causal links or deixis) are not yet shown in the story or inferred by the spectator. These stories besides not having explicit temporal utterances, to anchor events, are usually also not linear.

In chapter 3 I have discussed about these narrative figures (the ellipsis to which I refer to,) aren't those that are not anchored to the story axis for brief intervals (as occurs for external flashbacks that require more events of narration before being recognized as such) but to the events that remain disanchored also after that the macro event at which belong the event concludes itself.

The stories with hypothetic ellipsis are characterizing structures of movies with complex plot, better known as *Puzzle Film*. Examples of such movies are: *Pulp Fiction*, *21 grams*, *Babel*, *Incendies*, *The Burning Plain* and *Memento*. I belief the term puzzle is an adequate adjective for this kind of movies – in fact the narrative structure reflects the puzzle game – in which every event, macro event or partial story can be considered as a puzzle piece waiting to be positioned on the temporal axis of the story.

While from spectator's point of view the reconstruction of the story (of the fabula in a movie) consists of reconstructing a puzzle, the theorist's task is much more complex: in addition to anchoring the events on the story axis, he has also to explain how the spectator is arrived to execute every specific anchoring – if is a theorist with a cognitive approach, he has to exhibit also the cognitive rules that hypothesizes are chosen and applied by the spectator for every break or anchoring he has performed[21].

PULP FICTION. I believe that, thanks to this movie, the hypothetic ellipsis has began to be adopted (also in intensive manner) in the narrative movie structure.

In *Pulp Fiction* there is an hypothetical ellipsis that is created at the beginning of the telling, and is linked to rest of the story through an anchoring for repetition of events – such deixis therefore has a very big wideness. Although various movies produced in the latest years present an high number of hypothetical ellipsis, no film reaches the wideness of the famous movie of Q. Tarantino. In figure 7.7.1 I report a diagram TN-TS-TB with a step of analysis that is equivalent to an episode of the telling. In Appendix 10 I report a complete analysis of *Pulp Fiction* based on the spectator's beliefs on events of the story, and in appendix 11 the relative TN-TS-TB diagram.

DEIXIS IN CASCADE – MEMENTO, 5X2 CINQ FOIS DEUX. The global temporal structure of *Memento* is constituted by different sequences that by a cognitive point of view constitute macro events. The movie has two main lines of narration: a first that goes backwards in the story time, activating at every begin of a new sequence an hypothetical ellipsis (see figure 7.7.2); a second line proceeding in a linear way, that is reported to the spectator by a group of events in black and white. The hypothetical ellipsis belonging to the backward telling, once activated, remain opened until, when from new events of story, the spectator activates a deixis for repetition of events (in the

21 These last observations give us an occasion to point out that some authors as S. Aprahamian [Aprahamian] on Wikipedia have reported some temporal diagrams of reconstructions of movies with complex plot (in particular the diagram of *Memento*). Differently from the approach presented in this book, in [Aprahamian] is given only the diagram relating to the fabula temporally constructed (the construction of the puzzle) without reporting the justifications of spectator's cognitive activities, for each anchoring performed.

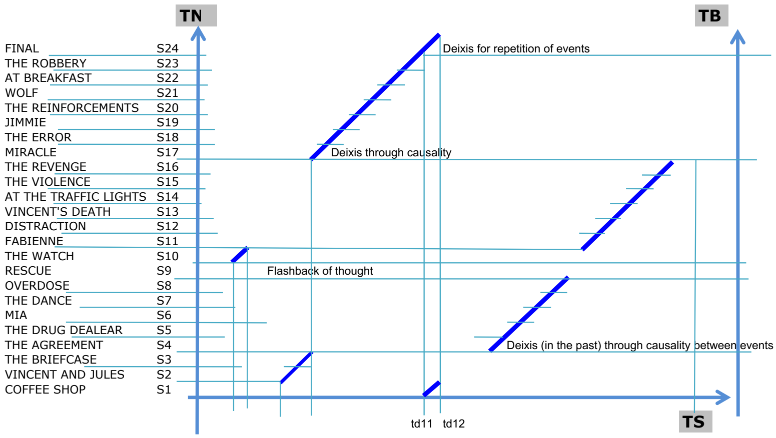


Figure 7.7.1: *Pulp Fiction* - TN-TS-TB diagram at the end of the movie vision

example in figure 7.7.4 the event $e8$ is a repetition of $e1$). With a certain structural regularity – for 14 times – the fitting with other story events occurs after the spectator has inferred and recorded that the final event (the event $e8$ in figure 7.7.3) of an episode N+1-esimo is a repetition of the first event ($e1$ in figure 7.7.2) of the previous episode N-esimo. This repetition of events, for the cognitive inference presented in chapter 5, leads the spectator to anchor the events ($e1$ and $e8$ of the example) on the same temporal interval. On the same line of the backward telling, beside the deixis for repetition of events, there are other deixis that in the paragraph 5.4 I have called – **anchoring for the anticipation of the effects** (inference 5.4.7 in the chapter 5) – such deixis generate a back into the past. The anticipation is an event that, in a determined part of the telling (introduced or mentioned by some character) happens into the past – afterwards in the narration this event is presented in the diegesis (in some way shown in the story). As example I give a filmic segment in which – in a bar Natalie says (En) to Leonard ”take your keys you forgot at my house” (the spectator infers that Leonard has been at Natalie’s house” (Em)). In the following sentence, when the story shows Leonard at Natalie’s house (En), the spectator infers that the diegetic interval of the sequence about ”Leonard at Natalie’s house” (Em) diegetically precedes in time the event (En) of the act of telling (happened into the bar).

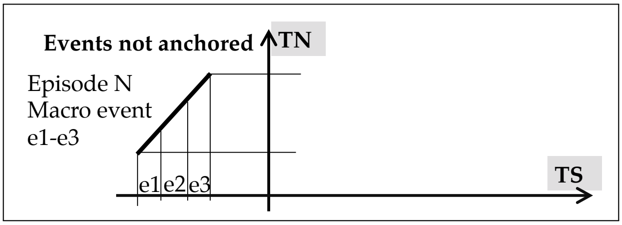


Figure 7.7.2: Hypotetical ellipsis in *Memento* in the phase of suspension

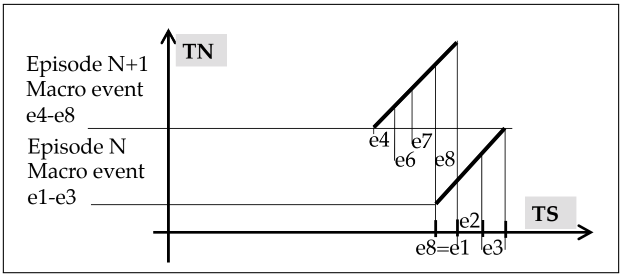


Figure 7.7.3: Hypotetical ellipsis in *Memento* after the fitting

”Leonard’s story in the hotel room” is a partial story that alternates in the telling with ”Leonard’s story that goes backwards”. Every time you start in the telling ”Leonard’s story in the hotel room” the spectator is warned as the story events are staging in black and white. After some passages in this modality the spectator learns such *coding*[22]. The spectator however performs anchorings among the events of “Leonard’s story in the hotel room” by applying inferences relating to causal-temporal deixis (inference 5.4.1), in which every macro event of the “Leonard’s story in the hotel room” causes the macro event that follows it – in this way all events belonging at “Leonard’s story in the hotel room” are linear. The global structure of *Memento* is very particular—it is constituted of macro events series placed on the story axis (see figure 7.7.4). Todd’s killing, that is the last event of the story, is shown in the first sequences of the telling, while the beginning of the story is placed in the end of the narration. *Memento* has a high cognitive cost, as it hasn’t cognitive hooks – there aren’t particular cognitive states of expectation, but there are only generic events, in which the spectator doesn’t activate specific markings

22 The French researcher Yannick Mouren has written an interesting book *La couleur au cinéma* [Mouren2012], in which in a way exhaustive analyses the use of the colour in the cinema – in particular the adoption of the color to represent passages of a story from the present to past.

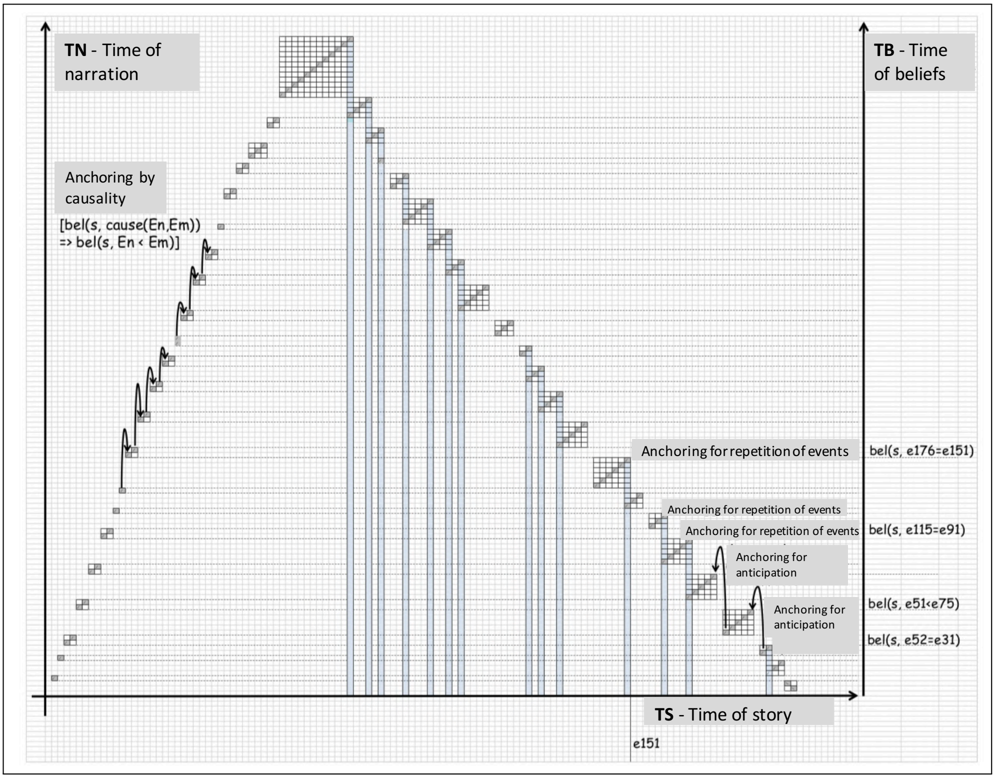


Figure 7.7.4: *Memento* - TN-TS-TB diagram

– every event appearing on the screen, can potentially be evoked in future for an eventual anchoring.

Memento has been widely analyzed and discussed among cinema theorists[23] – my contribute to the analysis of this movie has been to have reported, for every meaningful events of the story, the correspondent spectator's cognitive inference. Briefly, in *Memento* are present:

1. in "Leonard's story that goes backwards" — 14 deixis for repetition of events and 7 deixis with anticipation of causal effect;
2. in the "Leonard's story in the hotel room" – 20 deixis for the causation of events;
3. one deixis for repetition of events (the main one linking the two stories)

23 In [Ghislotti2009] pp. 87-106 is already reported an extensive analysis of the movie *Memento*.

Although it is true that in the telling the hypothetic ellipsis are linked with a wideness of inferences not very large (they last the time of the telling of a macro event – a medium time of about 17 minutes), there is however to be observed that the ellipsis and links in *Memento* are very numerous (a total amount of 43). The complete analysis of *Memento* is reported in Appendix 11.

A narrative structure similar to the story backwards of *Memento* is that of *5x2 - Cinq fois deux*[24]. In this film every final event of a new macro event is a repetition of the first event of the previous macro event - just like it happens in the narration of *Memento*.

21 GRAMS. The movie presents many hypothetical ellipsis. As reported in figure 3.6.6 (paragraph 3), in which you can observe a number of ellipsis many high at the beginning of the telling. Generally the ellipsis in this movie are linked to the rest of story through the temporal causal relation (see inference 5.4.1).

Compared to other movies using the suspensions, *21 Grams* to aggregate partial stories, a new inferential paradigm is introduced. I call this type of paradigm **weak deixis**, where events having the same adjectives are similar. An example of shared property between two characters is the one present, in *21 grams* in which in a macro event, a seriously ill man is shown in a hospital (I have already mentioned this story segment in paragraph 5.7). Later in the telling, a woman states that her husband is nearly to die – then the spectator believes that man who was in the hospital is the woman's husband.

To represent the inference mentioned, we instantiate the cognitive rule 5.7.6 at time of the telling tx=[1,52,44] correspondent to the instant in the story when the woman says "my husband is nearly to die". In an informally way: Spx believes that P1 and P2 are the same character if Spx believes that: P1 takes part to the event E1; the health status of P1 is seriously ill; P2 takes part to the event E2; the health status of P2 is dying; P1 and P2 have similar

24 *5x2 - Cinq fois deux* [5x2]

properties – the name of the properties are similar (are the same), the value of the properties dying and seriously ill are similar. Formally:

$$\begin{aligned}
& mev(tx, bel(spx, sameP(p1, p2))) \leftarrow \\
& \quad mev(tx, bel(spx, who(e1, p1))), \\
& \quad mev(tx, bel(spx, propEv(e1, prop(healthStatus, p1, seriouslyIll)))), \\
& \quad mev(tx, bel(spx, who(e2, p2))), \\
& \quad mev(tx, bel(spx, propEv(e2, prop(healthStatus, p2, dying)))), \\
& \quad mev(tx, bel(spx, isLike(healthStatus, healthStatus))), \\
& \quad mev(tx, bel(spx, isLike(dying, seriouslyIll))), \\
& \quad spr(Tx, Spx, healthStatus, seriouslyIll).
\end{aligned} \tag{7.7.1}$$

With 5.7.7 having the following instantiation:

$$\begin{aligned}
& spr(tx, spx, healthStatus, seriouslyIll) \leftarrow \\
& \quad mev(tx, bel(spx, highSpec(healthStatus))), \\
& \quad mev(tx, bel(spx, highSpec(seriouslyIll))).
\end{aligned}$$

In *21 grams* there are many weak deixis that use some adjectives associated

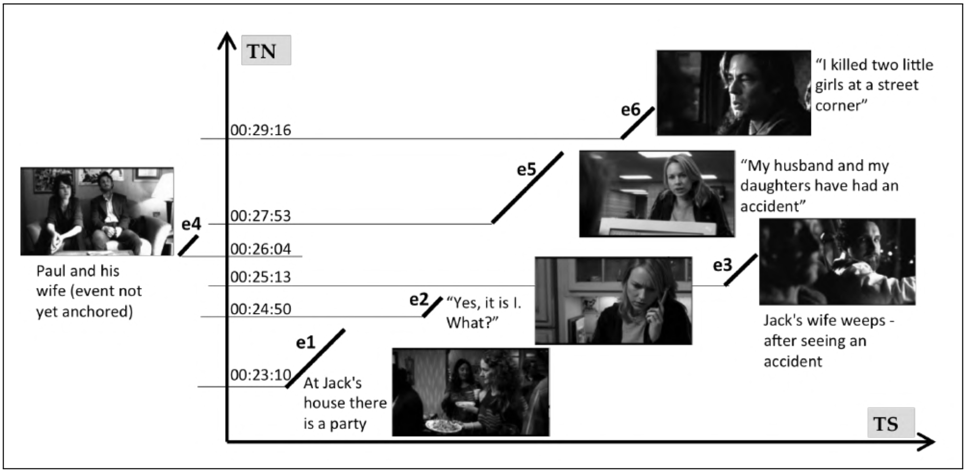


Figure 7.7.5: A complex puzzle in *21 grams*

to the events (dangerous, mysterious, joyful, etc.) permitting the spectator to reach the conclusion that two events $E1$ and $E2$ are the same (or similar) events – $bel(Spx, sameE(E1, E2))$ ($bel(Spx, is\_like(E1, E2))$) ($E1$, $E2$ are shown in the film in two different intervals of the narration).

As example, I take into account the part of the movie in which the central fitting of the story occurs (see the figure 7.7.5). This fitting regards the link of two partial stories, that of Christina (the woman who loses her husband and the two daughters in a car crash) and that of Jack, the man responsible of the crash. In [00,23,10], the telling shows the Jack's house, where it is celebrating the Jack's birthday ($e1$). The latter has not yet come, and his wife is waiting for him.

At the time of narration [00,24,50], Christina answers to the telephone – an event ($e2$) has happened. From Christina's answer – "what?" ($e2$) – and from her voice, the spectator infers that it is a tragic event:

$$\mathit{mev}([00,24,54], \mathit{bel}(\mathit{spx}, \mathit{adjEv}(e2, \mathit{tragic}))).$$

In another event ($e3$) Jack's wife cries – at that moment the spectator doesn't possess the knowledge to establish what has happened – he only labels $e3$ as a tragic event:

$$\mathit{mev}([00,25,13], \mathit{bel}(\mathit{spx}, \mathit{adjEv}(e3, \mathit{tragic}))).$$

After the acquisition of this last belief we can suppose that in the spectator's cognitive space is generated the belief that the tragic event is happened to Christina, it is the same tragic event about which Jack's wife becomes aware – also if the viewer does not yet know anything about what happened in that event. They are two events having the same property: the being tragic. In a real world two events having this property do not represent a particular coincidence – the tragic events are daily reported to us through media – and nobody believes that are the same, only because they have an adjective (a property) in common.

For the events of the film movies, instead, if an event $E1$ has a property (also enough generic), common to an event $E2$ that is shown in the story, the latter is always almost associated by the spectator to event $E1$. This occurs above all because the number of the events of a story is very restricted, moreover each of them has few properties. The rule has a more force if the property associated to events is singular (dramatic, tragic, joyful, etc.). This discussion lead us to define for the events an inference similar to the one presented for the properties in the paragraph 5.7, in the following way: $E1$ and $E2$ are the same events if Spx believes that: $E1$ has the adjective $Adj1$; $E2$ has the adjective $Adj2$; $Adj1$ is a singular adjective; and $Adj1$ and $Adj2$ are similar. Formally:

$$\begin{aligned}
&mev(Tx, bel(Spx, sameE(E1, E2))) \leftarrow \\
&mev(Tx, bel(Spx, adjEv(E1, Adj1))), \\
&mev(Tx, bel(Spx, adjEv(E2, Adj2))), \\
&mev(Tx, bel(Spx, sing(Adj1))), \\
&mev(Tx, bel(Spx, isLike(Adj1, Adj2))).
\end{aligned} \tag{7.7.2}$$

Applying the rule 7.7.2 the viewer supposes that events $e2$ and $e3$ are the same event

$$bel(spx, sameE(e3, e2))$$

I continue the analysis of the filmic film segment shown in figure 7.7.5. At chronological time [00,27,53] Christina says her husband and her daughters have had an accident[25]

a: $bel(spx, what(e5, say(christina, e6)))$
b: $bel(spx, what(e6, accident(husband)))$

Also for this diegetic situation $bel(spx, adjEv(e5, tragic))$ is valid, and to this belief is added another one of the spectator that $e2$ is the same tragic event $e5$ ($bel(spx, sameE(e2, e5))$) of which Christina already knows the what, the when, and the cause. It is a focalization in which the narrative instance *knows more* than of the spectator (see paragraph 6.5). Through the event $e5$ the spectator has the confirmation of the severity of the event $e2$.

At time [00,29,16] Jack confesses (e6) to his wife of having killed a man and his two children. Jack and Christina's stories are now an only story – the accident $e6$ about what Christina is speaking at the hospital, is the same event described by Jack of the crash car in which have been killed a man and his daughters:

$$\begin{aligned}
&mev(Tx, bel(spx, what(e6, crash_car(jack, christina_relatives)))), \\
&mev(Tx, bel(spx, sameE(e5, e6)))
\end{aligned}$$

25 The belief b is assumed by the viewer for the activation of the rule 5.5.1 introduced in 5.5.1

After $e6$ is presented in the telling, the belief $\mathsf{bel}(\mathsf{spx}, \mathsf{sameE}(e5, e6))$ is a deixis that connects the story of Christina and that of Jack. This is because $e5$ and $e6$ are events that have the same description (see paragraph 5.2): the event reported by Jack to have killed a man with two children, is the same event reported to Christina in hospital.

In this way, the event $e3$ is fully explained – Jack's wife decides to go to the crash site, just because of Jack's confession. As the spectator believes that $e6$ causes $e3$ – $\mathsf{bel}(\mathsf{spx}, \mathsf{cause}(e6, e3))$ – there is also the implication that $e6$ precedes $e3$ ($\mathsf{bel}(\mathsf{spx}, \mathsf{prec}(e6, e3))$). The latter belief arises from the application of the 5.4.1 rule (see also figure 7.7.5, where $e6$ precedes $e3$).

21 grams shares with *Human Capital* many structural elements. In *Human Capital* the spectator many times applies the inferential rule 5.3.2 introduced in the paragraph 5.3 establishing that if an event $E2$ is a repetition ($\mathsf{bel}(\mathsf{Spx}, \mathsf{rep}(E1, E2))$) of another event $E1$ then $E2$ occurs in the same diegetic interval of $E1$.

The viewer acquires the condition of event repetition (the event is the one related to the accident car) without that in the diegesis a repetition of an action or other repetitions of event components have been presented. In these cognitive activities the viewer reaches the condition $\mathsf{bel}(\mathsf{Spx}, \mathsf{rep}(E1, E2))$ activating a some weak deixis for story events having the same category (automotive event):

$$\begin{array}{l} \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{spx}, \mathsf{catEv}(\mathsf{Ex}, \mathsf{Catx}))), \\ \mathsf{mev}(\mathsf{Tx}, \mathsf{bel}(\mathsf{spx}, \mathsf{catEv}(\mathsf{Ey}, \mathsf{Catx}))), \\ \ldots, \end{array}$$

21 grams and *Human Capital*, in the main part of the story, report the same events from different points of view. In these narrations from story events partially described, the viewer builds a puzzle made up of events in which the fabula, and the axis of the story, are totally reconstructed.

7.8 TEMPORALLY CONSISTENT FABULA

In paragraph 2.5 I have defined an act of vision V_i (that I report here with subscript i) in the following way:

$$V_i =_{def} visAct([TI_i, TF_i], Spx, Seg_i, [TDI_i, TDF_i], [E_{i,1}; ..; E_{i,n}])$$

for each visual act i there can be n diegetic events ($[E_{i,1}; ..; E_{i,n}]$) in order to take into account that in an vision act the spectator can believe that more events have happened in the diegesis. The vision of a movie can be considered as the set of all the vision acts:

$$Vision =_{def} \cup_i V_i$$

This set relates the narration chronological time with the diegetic time of the events (time of the story). In my formalism $\cup_i V_i$ is represented by the plane TR-TS, and catches the notion of plot proposed by U. Eco[26]:

> The plot of the story is how de facto it is told, as it appears on surface, with its temporal dislocations, forward and behind jumps (flash-forwards, flashbacks), descriptions, digressions...

U. Eco[27] in his famous book proposes also a definition of the fabula:

> The fabula is the fundamental scheme of the narration, the logic of the actions and the syntax of the characters, the course of the events temporally ordered. It may well not be a sequence of human actions and can regard a series of events regarding inanimate objects, or also ideas.

In a cognitive approach, the component of the fabula regarding the "course of event temporally ordered" (fabulaT) can be represented through the spectator's beliefs on the story events and on events temporal order that are acquired by the spectator during the film vision.

$$\begin{array}{ll} fabulaT =_{def} & \\ \cup_i bel(Spx, E_i) & \text{\% Spectator's beliefs on the story events} \\ \cup_{e,f} bel(Spx, prec(E_e, E_f)) & \text{\% Spectator's beliefs on the temporal} \\ \cup_{s,t} bel(Spx, eqT(E_s, E_t)) & \text{\% order of events} \end{array}$$

26 In [Eco1979] p. 102.

27 Idem p. 102.

While ”the logic of the actions” (fabulaC) can be represented through the spectator’s beliefs on the causal relations of the events (fabula as story):

$$\mathsf{fabulaC} =_{def} \cup_{s,t} \mathsf{bel}(\mathsf{Spx}, \mathsf{cause}(E_s, E_t))$$

In the end, we can represent “the syntax of the characters” (fabulaP) as the beliefs that the spectator possesses regarding character’s cognitive states:

$\mathsf{fabulaP} =_{def}$

$\cup_{j,k} \mathsf{bel}(\mathsf{Spx}, \mathsf{bel}(P_j, E_k))$	Spectator’s beliefs on the characters’ beliefs
$\cup_{s,t} \mathsf{bel}(\mathsf{Spx}, \mathsf{int}(P_s, E_t))$	Spectator’s beliefs on the characters’ intentions
$\cup_{f,t} \mathsf{bel}(\mathsf{Spx}, \mathsf{goal}(P_f, E_t))$	Spectator’s beliefs on the characters’ goals

From the definitions of plot and fabula, I formulate a definition of connection among events. Two events Ei, Ej are temporally connected in a fabula ($\mathsf{fabulaT}(\mathsf{Film}, \mathsf{Spx})$) if any of the relation about temporal beliefs exists:

$$\mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(Ei, Ej)).$$
$$\mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(Ej, Ei)).$$
$$\mathsf{bel}(\mathsf{Spx}, \mathsf{eq}(Ei, Ej)) \in \mathsf{fabulaT}(\mathsf{Film}, \mathsf{Spx}).$$

By using the previous definition we can affirm that a fabula is temporally connected when every pair of events Ei and Ej belonging to the plot are temporally connected. It is necessary to add another definition useful for the

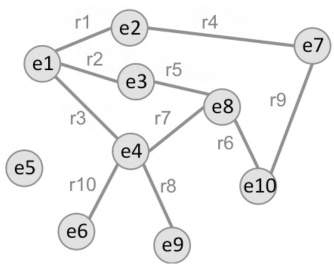


Figure 7.8.1: Graph of connections of the events

discussions concerning the closed and opened temporal stories regarding the temporal consistency. A fabula is temporally consistent when it doesn't exist any couple of events Ex, Ey so that[28]:

```
bel(Spx,prec(Ex,Ey)).
bel(Spx,prec(Ey,Ex)).
```

Obviously, a fabula that is temporally closed doesn't implies it is closed by a point of view of the story. This one to be defined in such a manner must grant that all the events composing it, should be casually connected. In an analogue way to the fabula concept, we will say that a story is closed (casually closed) if it is connected and if it is casually consistent. A fabula F is temporally inconsistent if it exists a spectator's belief regarding two events E1, E2 such that bel(Spx,prec(E1,E2)) and another belief (in a sense contrary) bel(Spx,prec(E2,E1)). Naturally to these two relations between the two events E1 and E2 the spectator can achieve also by applying some basic inferences regarding his cognitive rules (see paragraph 2.11) – not only by acquiring these temporal relations directly from the vision.

We can say therefore that a fabula F is temporally inconsistent if two events E1 and E2 exist in the fabula in correspondence of which there are two different derivations, where the spectator infers in one bel(A,prec(E1,E2)) and in another bel(A,prec(E2,E1)). In such a way **a fabula** F **is open** if is linked and temporally inconsistent. Regarding the definition given I desire to add some observations with the aim to stimulate a discussion on the definitions introduced.

One of the requirements always present in the definition of rational agent imposes that at every step of the revision of the cognitive state (a base of beliefs) of the agent is consistent[29]. The model of spectator I have proposed doesn't always possess this requirement. When a spectator perceives an inconsistence (an event that he believes can be placed before or also after another

28 I reported a qualitative definition of consistency. The introduction of the consistency or inconsistency of knowledge bases, would take us far away from the goals of this book. Notwithstanding I wish to report an approach of easy application for the detection of inconsistencies in the knowledge bases, which is that of the Answer Set Programming(ASP). The ASP formalism is used in this book to represent the spectator's beliefs. Starting from such representation the steps to reach a formal representation of the inconsistencies of the viewer's beliefs are not many.

29 see [Dragoni1996]

event – for example as it happens in an open story), and he doesn't succeed in eliminating it with some rule of restoring, belonging to his cognitive state, we can suppose the spectator feels a momentary discomfort (It can be supposed also that this is what the director desired) – but he doesn't begin to make mistakes on all other cognitive reasoning activities. On the contrary instead of what happens for a ordinary computer program that, in presence of an inconsistence, blocks itself during its execution, or deduces everything or enters a loop, the spectator *doesn't go mad*, nor stops watching the movie, rather he remains glued to the screen, to understand how it ends or to see if the remaining story gives him a key of explanation of the recorded inconsistence. In other words, also if the telling structure presents incongruity and inconsistencies, the spectator's cognitive state (also if feeling some perplexity or discomfort) preserves its cognitive integrity for his reasoning activities. This happens because the spectator believes that the story events belong to a fictional world, not to his daily real world. When something unusual, regarding the story consistence (and not only) happens in the representation, he cognitively perceives the fiction events with a certain indifference (he reassures himself by saying "it is just fiction"). A theory which aims itself to modelling an agent-spectator, has to take into account these factors and to consider the inconsistencies of the story as something distinct from the knowledge of the spectator's real world itself. I suppose that a spectator's model representing adequately the inconsistencies in the stories, must possess a meta-inferential level, so to label the inconsistent situations such as particular events of fiction, confining them in specific cognitive spaces, where he can accept the existence also of inconsistencies. As we will see there are stories in which the inconsistence can't be locally confined – but also in these extreme cases the spectator recurs to his meta-textual strategies to narcotize as much as possible, the effects of the temporal contradictions that are a serious menace to the traditional notion of story and telling.

7.9 LOCAL CONTRADICTIONS IN THE STORIES

I examine some narrative categories, in which are present incongruences among the events of the story. In such narratives it is required to the spectator to narcotize the exigence to desire his consistent cognitive state – narcosis that the spectator accepts as he loves the game of fiction, that leads him to record beliefs on story events he himself believes incongruous. For many stories containing incongruities – the spectator performs some restoration operations of his cognitive state using complex meta level inferences. For example in some stories (in chapter 8 I will analyze these type of narratives) there are pairs of events that exclude each other – in which the events cannot be present together in a same story. For such filmic situations to restore the incongruity that occurred in the story, the spectator hypothesizes the existence of two alternative courses of events, in which such events happen.

There are two main types of narratives that create contradictions in the spectator's beliefs, on the temporal order of the events, that are not removable by the spectator:

1. narratives where there is a contradiction – accepted and locally recorded – in which the inconsistence doesn't happen in all the story;
2. narratives in which the inconsistence is propagated in all the story.

The first category, that I discuss in this paragraph, regards the forms of local contradictions present in some kind of summaries for the elimination of events, as in the cases already seen in *Doctor Zhivago* and *Notting Hill*, in which the contradiction is generated as in a same diegetic space there are types of events requiring different execution times.

In *Doctor Zhivago* and *Notting Hill* there are two series of events (E_i and E_j) and (E_s and E_t) happening in a same diegetic space: in both the series there is the violation of the cognitive rule according to which two events having mutual participants (both character than physical objects see inference 7.10 in paragraph 3.2) happen in the same diegetic interval. In fact in *Doctor Zhivago* (see figure 7.9.1a) the series of events E_i shares besides the character (Zhivago), also some physical objects with E_j. The events E_i have a diegetic interval of some months, while E_j less than a minute – same temporal relations

(a) E_i = the passage from winter to spring; E_j = Zivago moves the finger on the iced glass

(b) E_s = the passage of the seasons; E_t = William Thacker walks in Notting Hill

Figure 7.9.1: Local contraddictions in the summaries - *Doctor Zhivago* (a) and *Nothing Hill* (b)

are valid between the series E_s and E_t in *Nothing Hill* (see figure 7.9.1b). The spectator accepts the violation of the cognitive rule and the relative contradiction, it is as if he splits the space into two parts and associates to these latter two different diegetic watches – one going as slowly as the seconds, the other as the months. The whole summary is moreover considered by the spectator as an only macro event that has as temporal extension the duration of the whole summary. Important factor is that this macro event (the summary) is anchored with other story events, without spreading the contradiction – that remains as a local phenomenon.

Local contradictions, as those of the summaries, are present in other forms in the stories. For instance, in *Italian Job* in the end of the partial story of the robbery set in Venezia (without cuts or shooting stops) is performed a tracking shot upwards, framing the sky with the same white clouds (in figure 7.9.1 we can observe the still images $visTime(tr1, [00, 16, 08])$ and $visTime(tr2, [00, 16, 11])$). The same sky and the same clouds are the starting point of the sequence set in the mountain – a same sky (a same space) seems shared to two places that are distant many kilometers. It is a tracking shot downwards that leads the spectator to frame the same group of participants to the robbery, that meet themselves to divide the loot. Now, for the spectator the sky isn't anymore that of Venezia and that of a mountain area (in figure 7.9.1 with $visTime(tr3, [00, 16, 38])$ and $visTime(tr4, [00, 17, 00])$.

Once more, the rule that a same space is synonymous of a same diegetic time, is violated. The clouds denote a same space – but the diegetic time is different – the story has made a forward jump of several hours, the characters now are in the mountain – we can say in this case it has been performed a **flashforward to the present**[30].

(a) Italian Job visTime(tr1, [00, 16, 08])

(b) Italian Job visTime(tr2, [00, 16,11])

(c) Italian Job visTime(tr3, [00,16,38])

(d) Italian Job visTime(tr4, [00,17,00[)

Figure 7.9.2: Flashforward to the present in *Italian Job*

7.10 GLOBAL CONTRADICTIONS IN THE STORIES

There are stories in which the contradiction is not isolated inside of a macro event and spreads in all the story. This happens because in such stories there are the conditions for the spectator of activating the inference 2.11.2, which

30 Here has been paraphrased the term "flashback to the present" adopted by the critics for Trois couleurs: Rouge [TroisCouleursRouge]. In the case of *Italian Job* "a same" diegetic space has been used notwithstanding the story jumps in forward in the future.

is relative to the temporal transitivity of the story events. A movie presenting this characteristic is *Before the rain*.

BEFORE THE RAIN (AN OPEN STORY). The movie is composed of three episodes possessing explicit indicators announcing the beginning of every episode. Moreover, the filmic text presents in the beginning of the second episode a radical change of characters and place, so to lead the spectator to believe (for a certain narration interval) that it is a film having different stories.

Before the rain is an open story as contains some inconsistencies that are spread in all the story. In this paragraph I discuss this latter aspect, reporting an analysis of movie through the annotation of the most relevant story events.

Episode 1 - Words. An aspiring monk named Kiril picks up$_{e1}$ vegetables in the monastery garden, tries to hit$_{e2}$ a fly on his neck. An older monk speaks$_{e3}$ to Kiril and says it will rain as the air is clammy — the flies announce the coming of the rain. Zamire hides$_{e4}$ herself in Kiril cell. The following day the older monk discovers this transgression to the monastery rules and expulses$_{e5}$ Kiril. Zamira and Kiril go looking$_{e6}$ for an accommodation. The attempt of Zamira's exodus is discovered$_{e7}$ by her relatives: her grandfather and some uncles. In an attempt to escape Zamira is shot$_{e8}$ by one of her relatives and dies$_{e9}$. Kiril is overflowing with sorrow, he is unable to make any movement, he is sitting on a suitcase, and hypnotized observes$_{e10}$ Zamira's corpse.

Episodio 2 - Faces. A woman (Annee) is taking a shower$_{e11}$, and has a worried expression. We understand she has learnt the news of an event which arouses worries: she is expecting$_{e12}$ a baby. In Anne's office there is$_{e13}$ a press release, in which there is a picture showing Kiril observing Zamira that is dead (it is a repetition of the event e10). Alex meets$_{e14}$ Annee. Between the two you can notice an ancient attraction. Alex tired of being a photographer of blood and wars tells Anne he would like to come back$_{e15}$ to Macedonia his country. Alex asks Anne to follow him$_{e16}$. Anne refuses$_{e17}$ the invite.

Episodio 3 - Images. Alex comes back to Macedonia$_{e18}$, receives a good welcome from his relatives, and establishes himself in his old house. Alex feels nostalgia for an Albanian woman Hana, who loved when he was young. Hana belonged to a faction rival to his family, and decides to go to visit her. He is welcomed by Hana's father. After some days Hana visits Alex, she tells him that she has a daughter, which killed a man of Alex's family, and has been taken by hostage and obliged, as punishment, to satisfy the sexual desires of a victim's relative. Hana asks Alex to intervene, and to bring her back home. Alex goes$_{e19}$ to his relative's house, the same who has taken as hostage Hana's daughter (Hana's daughter is Zamira – the same young woman of the facts happened in [e1-e10]). At Alex relative's house, Zamira (believed killed in the event e9) is alive$_{e20}$[31]. Alex brings$_{e21}$ the girl with him, he doesn't stop neither when he is ordered to stop$_{e22}$ with a fire arm by his cousin. This last one incited by another relative, shoots on Alex that dies$_{e23}$. Zamira escapes$_{e24}$. Zamira goes towards the monastery to take shelter$_{e25}$. A young monk (Kiril), is collecting vegetables in the monastery garden, and tries to hit$_{e26}$ a fly on his neck (the event $e26$ is a repetition of $e2$).

I perform the analysis of the spectator's temporal beliefs by taking as referral figure 7.10.1 – in which there are given the filmic sequences on the narration axis TN, the events on the story axis TS and the spectator's cognitive state on the axis TB of the beliefs. The events $e10$ and $e13$ are temporally linked (they happen on the same interval $\mathsf{bel}(Spx, e10{=}e13)$), this kind of anchoring (inference 5.3.3) has been defined in paragraph 5.3, and regards events that are shown in the diegesis indirectly through a media. In fact $e13$ is a kind of event repetition, reporting the dead Zamira in the agency picture. Moreover, the episodes $e15$ and $e18$ are linked by the relation $\mathsf{bel}(spx, \mathsf{prec}(e15, e18))$, as in London Alex says ($e15$) he would have gone to Macedonia, and after in the telling, the event $e18$ brings back Alex in Macedonia (deixis 5.5.11 presented in the paragraph 5.5.3).

At this point in the telling it happens the key event from a point of view of the story structure: Zamira is at Alex's cousin house – Zamira is alive ($e20$). Starting from this belief ($\mathsf{bel}(spx, e20)$) the spectator infers

$$\mathsf{bel}(spx, \mathsf{prec}(e18, e20))$$

and the event $e18$ happens after all the events of the episode happened in London (in figure 7.10.1 the event $e20$ is anchored according the anchor signaled with (2)). I analyze the same segment of story from another point of view. In paragraph 5.6 I have presented a deixis that establishes that the living time of a person is previous to that of his death, so the spectator according to this rule

31 To be noticed that Zamira had done a rapid appearance, little visible at a first reading to the movie, during the visit of Alex to Zamira's grandfather. The event relative to this appearance (for the spectator of difficult perception) in my analysis has not been taken into account.

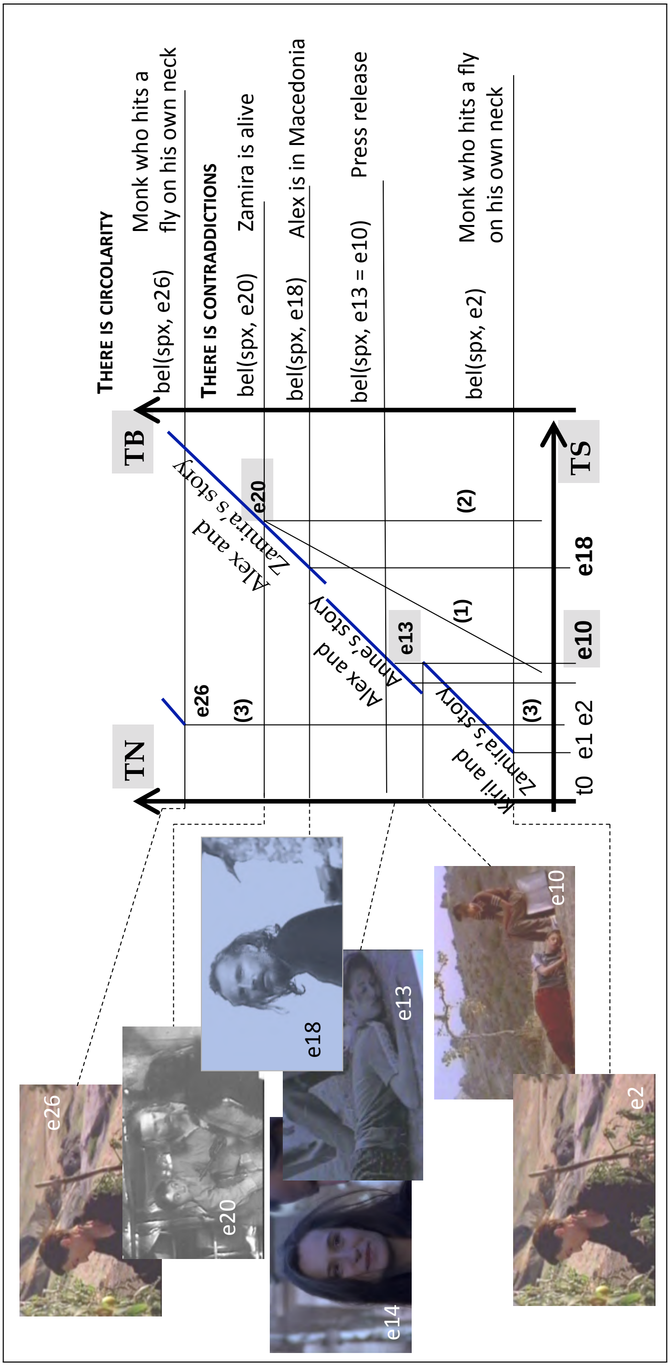


Figure 7.10.1: *Before the rain* at the end of the telling

acquires the belief $\mathtt{bel(spx, prec(e20, 10))}$, that is, if "Zamira is alive" this event happens (obviously) before her death ($e10$). How the events are temporally placed and through the application repeated of the transitivity among them (see inference 2.11.2), it is valid also $\mathtt{bel(spx, prec(e10, 18))}$ and so $\mathtt{bel(spx, prec(e20, 18))}$. According to the anchoring course (1), so, the event $e20$ must be anchored before $e10$ – but this in spectator's beliefs creates a temporal inconsistence. For the spectator is valid $\mathtt{bel(spx, prec(e18, e20))}$ (anchoring course 2) and his opposite $\mathtt{bel(spx, prec(e20, e18))}$ (anchoring course 1).

Before the rain therefore is an open story (see the conditions of the inconsistent fabula provided in paragraph 7.8). In qualitative terms – the story passes from the event in which Zamira is dead, to that in which Zamira is alive through events that are causally linked without there has been some temporal return in the past of the story. We have to notice that in the end of the telling, the event $e26$ happens – this is a repetition of $e2$ (the event of the monk who tries to hit on his neck a fly). We have once more a temporal contradiction, as on one hand the event $e26$ has to be anchored after $e10$, $e18$, $e20$.

On the other hand, $e26$ is a repetition of $e2$, the event has to be anchored on the same temporal interval as $e2$, so before $e10$. The event $e26$, for the cognitive relation of transitivity applyed among all the events that are in a causal relation of the story, makes the fabula, besides that open, also circular[32]

32 In the movie *Before the Rain* there are rapid passages, that together with the emotion provoked by the movie events, weaken the analytical capacities of the spectator. For this film I have carried out interviews to some viewers. The viewers he didn't recorded the quick appearance of Zamira at her grandfather house, they didn't perceived the temporal contradiction later in the telling, when Zamira appears in Alex's cousin house. Conversely other spectators have recorded the presence of Zamira in the scene. In this latter group, only some viewers have perceived the temporal contradiction. For these reasons I foresee that some readers of this book, who have watched the movie, could not recognize themselves in the particular deductive steps by me presented. My answer to this problem is that for a movie like this, rises the needs to have more than one model of spectator: a first distracted and not attentive to the particulars, a second who pays attention to particulars. Moreover, I have to say that (as more times told in this book) the basic events selected for the revision of the beliefs, are those that have been believed happen by the spectator in a first vision of the movie. I have excluded, in this way, to analyze the events of the story in a second vision. In *Before the Rain* it exists an event in the first episode, where Alex is dead and Anne is present to his funeral. Both characters are subsequently presented in the second episode, as important characters of the story, but at that particular vision interval of first episode, the spectator believes that Alex and Anne are secondary characters. It is clear that by a second reading of movie, the Anne

The contradiction, determined in the event $e20$, that brings the spectator to believe that Zamira is alive, extends itself in all the story.

We are at the limit of the notion of telling and story – the spectator is not able to eliminate the contradiction in his cognitive state. We can suppose that, at the end of the narration, the viewer believes that there are always three stories inside of which, the fabula is closed (by a point of view both temporal and causal), and suppose that the same spectator – is not able (in relation to the whole fabula) to reconstruct the temporal axis for the three stories together. We can also suppose that the existence of a contradiction doesn't create cognitive *imbalances*[33], note it doesn't lead him to escape from the armchair on which he is sitting, while watching the movie, rather he is glued to the screen, feeling maybe also some emotions of bother or anxiety (we can't affirm it surely)[34] but I believe that the spectator always activates his better (meta-filmic) reading strategy, by repeating once more to himself "it is just fiction".

TROIS COULEURS: ROUGE (FLASHBACK TO THE PRESENT). Another story presenting a global temporal contradiction is *Trois couleurs: Rouge* – I report here the analysis. In *Trois couleurs: Rouge* there are two partial stories: the story ($s1$) of the model Valentine (interpreted by Irene Jacob) and the old judge (interpreted by Jean Luis Trintignan); the story ($s2$) of Auguste – a law student. In the most part of the narration, the partial stories $s1$ and $s2$ are believed by the spectator not connected – such stories do not show any interaction between the characters. There is however a particular event presented nearing the end of the telling, when is revealed that a character, the

participation to Alex's funeral (although she is framed for a very short period) acquires a very different value in the story. I presume that the spectator, for example, can better appreciate the game of the circularity of the story and its original structure of the telling – but these are cognitive activities that the spectator can execute only in a second vision of the movie.

33 I have emphasized this aspect to underline that the spectator doesn't go mad in presence of a contradiction as it happens in the computational system of a calculator, in which when a contradiction happens in a base of knowledge the system can deduce something and its contrary.

34 In a famous interview to Mirko Manchevski, on his movie *Before the Rain*, he refers that the story structure proposed by him had the clear object of creating in the spectator a discomfort and something to destabilize him – he refers also that he hoped that his movie would start a new stylistic current in the cinematographic telling.

old judge, is the same character we find in $s2$, presented in younger age. In other words the judge is August, when will become old.

(a) Auguste seen from the window of the Valentine's house **(b)** Valentine sees Auguste's house from same window

Figure 7.10.2: Trois couleurs: Rouge – events belonging to the same diegetic space

(a) Auguste leaves home to take the car **(b)** Valentine leaves home to enter in the bar

Figure 7.10.3: *Trois couleurs: Rouge* – events have been linked through a continuous movement of the movie camera

In such time of narration, the spectator is forced to remember and revisit many of the events he has seen in the story. In particular he has to consider again all the sequences in which some couples of events $e1$ and $e2$ (respectively belonging to $s1$ and $s2$) have been visualized in a same scene (see the example reported in figure 7.10.2), as if the couples of events Ex and Ey, just mentioned, are also temporally simultaneous – in according to the cognitive rule presented in paragraph 3.2.

In addition after the revelation of the identity between young-judge and old-judge, the viewer has to apply the rule where states that the events in which a character is young always precede the events in which the same character is old ($\mathtt{bel(Spx, prec(Ex, Ey))}$) – deixis 5.6.2 introduced in 5.6. For this reason, the spectator places all the events connected with old judge thirty years forward from the events connected to the young judge. This spectator's implication is in conflict with existence in the story of some couples of events $\mathtt{E1}$ and $\mathtt{E2}$, belonging to the partial stories $\mathtt{s1}$ and $\mathtt{s2}$, which have been linked through a continuous movement of the movie camera (see the example reported in figure 7.10.3), and in according with the inferential rule 3.3.2 (reported in 3.2) two spatially contiguous events, are also temporally contiguous ($\mathtt{bel(Spx, meets(E1, E2))}$). In the sequence in which the two partial stories $\mathtt{s1}$ and $\mathtt{s2}$ intersect in the same scene through the two events overlapped, there is Auguste living at present time (he is the old judge), but in the same diegetic temporal arch, also the young judge is living, for his young age, belongs to the past of judge's life. In brief in the cognitive space of the viewer there are beliefs about couples of events $\mathtt{Ex}$, $\mathtt{Ey}$ – where:

1. $\mathtt{Ex}$ and $\mathtt{Ey}$ belong to the same diegetic space and therefore are temporally simultaneous ($\mathtt{bel(Spx, eq(Ex, Ey))}$);
2. $\mathtt{Ex}$ and $\mathtt{Ey}$ are bound by the deixis character-old – character-young for which $\mathtt{Ex}$ precedes $\mathtt{Ey}$ ($\mathtt{bel(Spx, prec(Ex, Ey))}$).

The two beliefs $\mathtt{bel(Spx, eq(Ex, Ey))}$ and $\mathtt{bel(Spx, prec(Ex, Ey))}$ generate therefore a contradiction in the cognitive space of the viewer. This circumstance make the story presented by K. Kieslowski open, that is, the spectator is not able to reconstruct the temporal axis of the story, for the presence of an inconsistence of his temporal beliefs. Nevertheless I believe that the spectator once again *anesthetizes* his capability of reasoning about time and events, ending up believing that there are two stories (even if when you try to connect them, you detect a temporal inconsistency): the Valentine's story and the Auguste's story – while the judge's story belongs to the present of Valentine's story and to the future of Auguste's story.

The points 1) e 2) were analyzed and labelled by cinema theorists, as **flashback to the present**[35].

35 By what is shown in the story of the film, I do not explain the reason for which this terminology was used – the movement of the camera, which incorporates the events in a same shot, concerns two events that belong to the story of Valentine and Auguste (to the time present). What makes the story going back into the past (if we consider the time where old judge lives

Figure 7.10.4: Valentine - *Trois couleurs: Rouge*

As narrative figure the flashback to the present (putting aside the terminological adequacy) is original and has some remarkable qualities. By from a cognitive point, you may have some problems of appreciation by the viewer. The reason is that the sophisticated game, shown in *Trois couleurs: Rouge*, can be comprehended only in the end of the narration (when the story reveals that the young judge and the old judge are the same person). The spectator, the ordinary one or also the one expert about cinema, until that point in the telling, hasn't elements to appreciate the sophisticate staging proposed by the author – he can understand his subtle form of narration, only at the end of the telling – by remembering what he has seen previously, or by reviewing the movie a second time.

Here comes back a crucial question that represents well the approach presented in this book, which takes into account the movie analysis only to the first reading and in which (as already referred) in a second reading, the film no longer becomes a matter of the spectator, but a matter of the theorist. It is true that the theorist with a cognitive approach has to model the spectator's mental

) or into the future (if we consider the time where young judge lives), is the deixis 5.6.2 (the events of the young characters precede those of the old characters) - in any case no flashback occurs (see definition in chapter 4 state, but he can't ascribe any belief to him, when a phenomenon as flash-back to the present is shown – the spectator hasn't the sufficient knowledge to recognize it.

7.11 DISCUSSION OF INCONSISTENCIES AND THEIR REPRESENTATION

There is a great difference between the inconsistencies that occur in a logical system and those that appear in the spectator's mental space. In most computational logic systems, such as ASP (Answer Set Programming), the management of inconsistencies has the following form:

$$\leftarrow \alpha, \beta, \gamma ...,$$

ie, when the α, β, and γ conditions are true and they are logically inconsistent set of facts, there is no mechanism to eliminate the inconsistencies when they occur.

In the cognitive space of a rational agent as the spectator "things" are different - when an inconsistency occurs, the spectator always tries to restore his cognitive state. To perform this restoration, the spectator must first record the logical incongruity - in his state of cognitive status. This logical deductive path is supported by the fact that the spectator does not go mad when an incongruity is present, he continues his internal cognitive activity. We have reason to believe that the viewer's revision process is divided into two steps:

$$\begin{array}{ll} \mathit{step1} & \mathit{mental\ state\ of\ incongruity} \leftarrow \alpha, \beta, \gamma \\ \\ \mathit{step2} & \mathit{consistent\ mental\ state} \leftarrow \\ & \mathit{incongruity\ elimination}, \\ & \mathit{mental\ state\ of\ incongruity} \end{array} \tag{7.11.1}$$

The method I propose is to characterize the types of incongruity, and then define specific cognitive actions that restore the cognitive status of the spectator (eliminating the inconsistencies).

If step 2 (the case of which is not rare) does not lead to the elimination of incongruity, the viewer remains in a cognitive state of incongruity. Here is a list of some types of incongruities:

- factual incongruity - the characters, the spaces and the diegetic times of the events are coincidental, but the corresponding actions are different. It is the case of counterfactual implicit figures[36], where the viewer eliminates the incongruity by placing the events, corresponding to the actions, in two different courses of events
- incongruity of duration - is the characteristic of some summaries, where inconsistency is confined to only the diegetic events concerning to the summary
- incongruity on temporal order of events - it is the case in which the story is globally inconsistent where for some events `E1` and `E2` - `prec(E1,E2)`, `prec(E2,E1)` - and the incongruity can not be eliminated
- incongruity due to different versions of the story reported by the characters, concerning a same group of events.;
- an incongruity arising from the violation of a rule that in the reality is valid but which in a fictional story it isn't. For example, in "The curious story of Benjamin Button" the biological aging time of the protagonist is not directly proportional to his age, while in real life this proportionality exists (I will discuss this story in the paragraph 8.3).

Explicit counterfactuality creates an incongruity in the spectator but does not activate any restoration process. The viewer accepts that in the story there are two courses of counterfactual events, because such a situation is declared, lived (chosen or suffered) by the story character. There is also a practice, although not rigorously accepted by the spectator, that in a story there can be two courses of counterfactual events. The viewer accepts this rule because he has seen other movie stories where this occurred.

As I have mentioned elsewhere in this book, the view of movie stories previously viewed by the spectator, establishes a cognitive background that influences the reading and understanding of a new story, often an incongruity that the spectator perceive is cognitively *narcotized* by some knowledge present in an other story.

36 I discuss this type of narration figure in detail manner in paragraph 8.2.1 in the next chapter 8.

8 COUNTERFACTUALITIES, LEVELS OF REALITY AND TIME TRAVELS

Bifurcations (spatial or temporal) of stories, levels of reality, time travels and other complex forms of narration, are elements present in some movie stories, that have put a strain on (and continue to do so) the film theorists, the philosophers, the logicians and the cognitive scientists. These stories launch of the challenges that construction lovers of theories, accept with great pleasure. Especially as are far away the complex stories from the possibility of being explained, through their mechanisms of understanding, especially as they are attractive and irresistible to their exploration and analysis. As for our attitude, we too are attracted by the difficulty of understanding these stories, even if the goal of this book is to choose, a set of phenomena (also limited) in relation to which we can formulate some formal models. My approach to the construction of cognitive models regarding counterfactuality aspects, levels of reality and time travels, starts from the presupposition that there are basic cognitive mechanisms of common sense that allow the spectator to comprehend these kind of narratives. I believe that when these elements are present in a tale, they involve various scientific theories that make the discussion stimulating, but that often they are far from the effective knowledge of the viewer, and from the mechanisms they uses to execute cognitive activity regarding it.

The fantascientific stories also if have been inspired by important physical theories as the restricted relativity, the general relativity and the quantistic mechanic, have generated an *epistemology parallel* to that of the scientific theories, developing own laws present in every movie of fantascientific genre released in the halls. In other words, science has its methods and its objectives the fiction has others. The scientist proposes laws, he corroborates them and applies the existing ones – his referral is the physical reality that those laws describe – he is obliged to compare with such a reality. The spectator in watching a movie has a main motivation – he desires to assist to a show – among its objectives there is not the one of undertaking protest actions for the falsity of physical laws proposed in the telling, but to comprehend the story, without hard and precise comparisons with the real world, by controlling only the consistence of the events inside it. Paradoxes regarding fantascientific stories are presented in the movie stories, almost always without that the filmic text gives a solution or a full scientific explanation – it could not be otherwise, the laws to be explained are false - to the viewer it is asked to accept what is shown on the screen: objects that move with the thought, people who travel in time and artificial worlds that exist in the minds of some character. Starting by what happens in the story and by the physical phenomena reported in it, the spectator builds new laws — or better pseudo laws – that can be true in some fictional world and false in the real world.

COUNTERFACTUALITY, LEVELS OF REALITY AND TIME TRAVELS AS NARRATION FIGURES. In this chapter I deal with some fundamental narrative figures - well characterized from the cognitive point of view, of which at the moment we can draw three qualitative profiles:

time travels – when a story adopts these narrative forms, the spectator has in mind some temporal contexts in which the characters enter through a machine or an instrument that allows them to undertake a time travel – such journey is always explicitly cited in the story, and often it is explained the physical law (or the pseudo law) that justifies the phenomenon. Time travels in many of these stories have the motivation of changing the past, for changing the future;

counterfactuality – for such narrative form the spectator has in mind alternative courses of events that are developed on a same diegetic time interval – the basic characterization is that there are some events that exclude each other, and others that superimpose themselves in an incremental way (for instance, the characters use knowledge about events that happen in other courses of events). A counterfactual narrative figure often has the function to compare facts and outcomes of two different stories, which differ themselves for some determinant event;

reality levels – are perceived by the spectator as spatial contexts, where the story characters enter and go out with precise rules. Reality levels are considered by the spectator also as story spaces capable of generating other spaces (other levels of reality) that almost always maintain alive the spaces that they have generated. In these kind of stories, the characters or enter in existing levels of reality, or enter in levels generated by the level of reality in which they live.

What I have reported is a first sketch of the categories I intend to represent through spectator's cognitive models. I have chosen the time travel, the access to counterfactual events and the entrance to a reality level as reference categories for the analysis of stories, as I consider these forms, to all intents and purposes, narrative figures such as the ellipsis and the flashbacks. We remember that these latter figures in this book have been modeled as local phenomena of narration, in particular through two cognitive states that are generated by two contiguous events in the story.

Time travel, the access to a course of counterfactual events and the entrance to a level of reality, as figure of narration can be also all present in a same story. A story in which there is a time travel, often presents some counterfactual events, for example in Harry Potter and the Prisoner of Azkaban[1] and in Back to future II in which in the story there are time travels generating courses of counterfactual events.

It also results that a story presenting forms of counterfactuality among courses of events, such as *Life is wonderful* and *Sliding Doors* can also be present temporal-spatial contexts similar to reality levels.

TO ASSIGN A STRUCTURAL CATEGORY TO AN ENTIRE STORY. According to my point of view that considers time travel, counterfactuality and reality levels as narrative figures, rises the problem to attribute a category to a story – as in one narration may be present more than one of the cited figures.

What will be the structural category that we can attribuite to an entire story? How (if we wish to do it) can we say that is it a story that regards a time travels, reality levels or counterfactual course of events?

1 *Harry Potter and the Prisoner of Azkaban* 2004 directed by Alfonso Cuarón, a cinematographic adaptation of the homonymous story, third episode of Harry Potter saga, written by the British author J. K. Rowling

To assign a category to a story, my choice has been once again[2] that of taking the predominant narrative figure, generally it occurs sooner in the narration and of consequence determines the other global characteristic of a story.

COURSE OF EVENTS AS NARRATION STRUCTURE. The courses of events are the entities that can be used to segment and analyze stories – in the same way in which the scene, the sequence and the episode are used, in a classical approach to the film analysis, or even an event macro in a cognitive approach. The course of events are introduced in detail in next paragraphs – I consider such entity as basic structures of narrations where counterfactual events, time travels and levels of reality, are present.

8.1 COURSE OF EVENTS

Every course of events of a story constitutes in the spectator's mind a particular closed world of events – having a well defined set of rules that characterizes it. The course of events can be assimilated (for all purposes) to a context of knowledge[3] – almost always consistent, that is without contradictions, nor temporal, nor causal – in which the spectator isolates groups of beliefs on

2 See the criterion used in chapter 7 to attribute an category to a story, I choose the predominant structural characteristic (linear, continuous, suspended anchoring, and so on) present in a telling.

3 The type of representation proposed in this book for the courses of events – has been inspired from the theory of the multi contexts [Serafini2002], [Ghidini2001], proposed in the researches of the rational agents. The theory of multi-contexts has been developed by F. Giunchiglia, starting from R. Weyhrauch's theory on Mechanized Formal Reasoning [Weyhrauch80]. Multi-contexts theory has received the contribution of many researchers belonging to Mechanized Reasoning group of Trento and Genova (M. Benerecetti, A. Cimatti, C. Ghedini, E. Giunchiglia, R. Sebastiani, L. Serafini, P. Traverso). We point out also the philosophical framing work of the theory by P. Bouquet [Bouquet1998]. In the multi-context theory there are two notions the one of locality, and the one of compatibility. The first defines a context as a portion of knowledge with its own language, a set of axioms and some inferences rules, that are characterized by the portion of the world you wish to model. The second notion, the one of compatibility, is relative to the links existent among contexts, that have to be respected to make compatible all the other knowledge, when the knowledge in a specific context changes.

the story events that are adjourned and revisioned every time new events are shown on the screen.

The events belonging to course of events of a story, possesses three strong characterizations:

- events within a course of events are causally and temporally consistent (Respect of integrity criterion), when the consistency is violated, in the model there are rules for restoring the spectator's cognitive state;
- access rules to courses of events are specific from story to story (Specificity of the access);
- there are specific relations between events among different courses of events (Rules of compatibility)

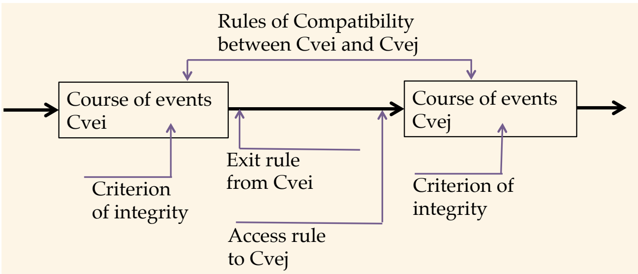


Figure 8.1.1: Integrity Criterion - access rules and compatibility

CRITERION OF INTEGRITY. Inside a course of event of a story, all the causal and temporal reasoning rules until here introduced are valid: the causal-temporal fundamental rule 5.4.1, the temporal consistence of the events, all the temporal and non-temporal deiptic rules, moreover, in a same course of events the factual consistency is valid, that is that there can't exist two events that exclude each other[4].

4 I have supposed, that there is consistence in a course of event, as until now, notwithstanding the authors' fertile creativity, have not been produced film on time travels, counterfactual or reality levels with stories presenting, inside of a course of events, temporal inconsistencies or factual inconsistency. If stories with such characteristic, should appear in a future movie, we can affirm (also if we haven't explored in detail this possibility) that the inconsistency shouldn't propagate themselves in all the story, this for the same definition of "course of event" that confines the knowledge into specific contexts.

I have denominated the absence of all the typologies of inconsistencies inside of the spectator's mental state as integrity criterion, that I have supposed to be valid for all the types of stories and all the events that happen inside of a course of events – this involves that some cognitive rules are valid for events belonging to a same course of events, but could not be valid if applied to events belonging to different courses. For example in a story, in which there is a time travel, inside of each course of events is valid the causal-temporal rule 5.4.1, that, we remember, establishes that an event causing another event proceeds it temporally – but among courses of events before and after the travel, this rule is not valid. As it happens in many of these stories, a machine M travelling in time starts from a course of events $Cve1$ and comes back in time generating a new course of event $Cve2$. If M returns back in time, then all the events of the course of events $Cve2$ are antecedent to the ones in $Cve1$ – the temporal-causal rule 5.4.1 among courses of events can't continue to be valid, as all the events occurring in $Cve2$ are caused by the machine that has made the travel, so the events in $Cve1$ would be antecedent to $Cve2$ – consequence that would bring to an inconsistence in the spectator's mental state that this latter cannot accept. I do not believe that the viewer wishes to give up the notion of travelling in time in the film stories, so I have to suppose that the spectator doesn't apply in his temporal reasoning the causal-temporal rule 5.4.1, or better it doesn't apply it on two events belonging to different courses of events.

The criterion of integrity is also not valide among courses of events where there is not persistence of the physical properties of an object. For example, a pencil that is broken in a course of events, is shown to the spectator intact in another course of events[5].

ACCESS RULES TO COURSES OF EVENTS. The access to a course of events is regulated by precise modalities and rules, no matter if they are explicitly or implicitly enunciated in the diegesis. These rules varies from story to story, and regard the modalities with which the access to the counterfactual contexts, levels of reality or temporal contexts happens. Examples of these rules are reported in the tables 6, 8 and 10. It happens often that the modalities with which for the first time in the narration you access a course of events,

5 The example is a quotation of an event that is present in *Groundhog Day*.

establish also the rules with which the access (with the same modalities) happens in the part remaining of the telling. There are some stories in which the modalities and the rules of access change during the narration, when these rules change (almost always they are explicitly justified) the reason of this change is reported in the story.

The belonging of an event at an event course takes place through the following steps:

1. every time a new Ex event occurs in the story, the spectator Spx assumes that Ex belongs to an event course (he creates a new mental label $Cvex$ for the course of events);
2. if a new Ex is visually contigue to another event Ey, and Ex does not generate an access to a course of events, Spx assumes that Ex and Ey belong to the same course of events – it is generated the belief

$$mev(Tx, bel(Spx, sameCe(Ex, Ey)))$$

3. if Ex is visually contigue to another event Ey, and Ex generates an access to a course of events, no belief is generated.

The notion of belonging to an event course is crucial. We can assume that every time an event Ex occurs, the spectator believes Ex is part of a course of event. The belonging to a course of events is a primitive regulated by the axiom:

$$\begin{array}{l} mev(T2, addBel(bel(Spx, cE(Cevx, Ex)))) \leftarrow \\ \;visualActCe([T1, T2], Segx, Spx, Cevx, Ex), \\ \;segmentFilmic(Segx, [T1, T2]), \\ \;courseEvent(Cevx), \\ \;time(T2). \end{array} \tag{8.1.1}$$

Similarly to macro events if there is no change of course of events when an event $E2$ happens after an event $E1$ ($E2$ is visually contiguous to $E1$), then $E1$ and $E2$ belong to the same course of events.

$$\begin{array}{l} mev(Tx, bel(Spx, sameCe(E1, E2))) \leftarrow \\ \;mev(Tx, bel(Spx, cE(Cev1, E1))), \\ \;mev(Tx, bel(Spx, visualContiguous(E1, E2))), \\ \;not\; mev(Tx, bel(Spx, changeCev(E1))), \\ \;diegeticEvent(E1), diegeticEvent(E2). \end{array} \tag{8.1.2}$$

I have to introduce the expression $mev(Tx, bel(Spx, changeCve(E1)))$ which can vary from story to story, and some times also within a same story. Generally a change of course is determined by a character's access to a reality level, a counterfactual event course, or a course temporal of events:

$$\begin{aligned}
&mev(Tx, bel(Spx, changeCev(E1))) \leftarrow \\
&\quad mev(Tx, bel(Spx, cE(Cev1, E1))), \\
&\quad mev(Tx, bel(Spx, cE(Cev1, who(E1, Px)))), \\
&\quad mev(Tx, bel(Spx, cE(Cev1, what(E1, timeTravel(Cev1, Cev2, Px))))), \\
&\quad courseEvent(Cev1), courseEvent(Cev2), \\
&\quad diegeticAction(timeTravel(Cev1, Cev2, Px)), \\
&\quad diegeticEvent(E1), participant(Px).
\end{aligned} \tag{8.1.3}$$

$$\begin{aligned}
&mev(Tx, bel(Spx, changeCev(E1))) \leftarrow \\
&\quad mev(Tx, bel(Spx, cE(Cev1, E1))), \\
&\quad mev(Tx, bel(Spx, cE(Cev1, who(E1, Px)))), \\
&\quad mev(Tx, bel(Spx, what(E1, accessLevel(Cev1, Cev2, Px)))), \\
&\quad courseEvent(Cev1), courseEvent(Cev2), \\
&\quad diegeticAction(accessLevel(Cev1, Cev2, Px)), \\
&\quad diegeticEvent(E1), participant(Px).
\end{aligned} \tag{8.1.4}$$

$$\begin{aligned}
&mev(Tx, bel(Spx, changeCev(E1))) \leftarrow \\
&\quad mev(Tx, bel(Spx, cE(Cev1, E1))), \\
&\quad mev(Tx, bel(Spx, cE(Cev1, who(E1, Px)))), \\
&\quad mev(Tx, bel(Spx, what(E1, accessContr(Cev1, Cev2, Px)))), \\
&\quad courseEvent(Cve1), courseEvent(Cev2), \\
&\quad diegeticAction(accessContr(Cev1, Cev2, Px)), \\
&\quad diegeticEvent(E1), participant(Px).
\end{aligned} \tag{8.1.5}$$

I will provide later in this chapter additional access rules of this type.

COMPATIBILITY RELATIONS AMONG COURSES OF EVENTS. Events belonging to a course of events can have relations with the events of others courses – these relations can condition reciprocally the events in the respective courses.

If exist relations among courses of events (they are not always present) they will be respected[6].

6 I have denominated they as relations of compatibility among courses of events – it is a term that I borrowed from the multi-contexts theory already mentioned earlier.

Also the relations of compatibilities vary from story to story (from movie to movie) and from character to character. There exist compatibility rules in many stories based on courses of events, in which objects or people travelling in time or that belongs to two alternative counterfactual stories, are linked by particular relations. I introduce a primitive that permits us to define without ambiguity the relation of compatibility for a same character. The reader will remember that in the story with complex plot, a character appearing in different macro events (or in different partial stories) with an age or a different aspect, was represented in the spectator's cognitive space through the relation of belief $bel(Spx, sameP(Px, Py))$, expressing the belief that Px and Py were two occurrences (apparitions) of the same character in the story. In a model of narration with courses of events, I will adopt the most adequate representation:

$$bel(Spx, cE(Cev1, who(Ex, Px))),$$
$$bel(Spx, cE(Cev2, who(Ey, Py))),$$
$$bel(Spx, homologousP(Px, Py))$$

through these relationships we express that a character Px, in a course of event $Cev1$, has his homologous in the character Py in the course of event $Cev2$. The belief has been inserted in the representation of the models, as often the characters Px and Py when passing from a course of event to another, can have different aspect and properties, and so it is inappropriate to use terms as "the same character", "the character when he was young", and so on. In an analysis of stories such as *Avatar*, it seems correct using for Jake Sully, who in a reality level has a mobility impaired, the term "homologous of Jake" when I refer to an avatar living on Pandora (other course of event) that has his same feelings and intelligence.

The examples I give in the following of this chapter, are those in which among courses of events there are physical persisting properties, belonging to objects and mental properties regarding the characters' remembrance about events of other courses of events. In the story *Groundhog Day* for example, the protagonist Phil remembers what happened the previous day and uses it, day after day, for building his ability as piano player. That of the persistence of the properties is a rule of compatibility that is not always valid – but if it is, it is almost always respected every time there is an access to a new course of events.

If it exists a persistence of a character's mental state, when he passes from a course of events to another, this must be represented by an explicit rule of compatibility between contexts. In the context theories there is an operation denominated lifting that allows us to put in relation the truth of a formula in a context[7], with the truth of a formula in another context. The persistence of a character's memory exists from a course of event $Cev1$ to another course of event $Cev2$ – in $Cev2$ a character's new mental state can obtained, through a lifting operation, such type[8]:

$$\begin{aligned}
&mev(Tx, bel(Spx, cE(Cev2, bel(P2, what(E1, Az))))) \leftarrow \\
&\quad mev(Tx, bel(Spx, cE(Cev1, bel(P1, what(E1, Az))))), \\
&\quad mev(Tx, bel(Spx, cE(Cev1, who(Ex, P1)))), \\
&\quad mev(Tx, bel(Spx, cE(Cev2, who(Ey, P2)))), \\
&\quad mev(Tx, bel(Spx, homologousP(P1, P2))), \\
&\quad mev(Tx, bel(Spx, diegeticMentalPersistence(P1))), \\
&\quad diegeticTime(Tx), diegeticAction(Az), \\
&\quad courseEvent(Cev1), courseEvent(Cev2), \\
&\quad participant(P1), participant(P2), \\
&\quad diegeticEvent(E1), diegeticEvent(E2), \\
&\quad diegeticEvent(Ex), diegeticEvent(Ey).
\end{aligned} \tag{8.1.7}$$

The inference 8.1.8 regulates the persistence of the character's cognitive state $P1x$ that passes from a course of events ($Cve1$) to another ($Cve2$), where there is his a homologue $P2x$. In order to ensure the persistence of the whole mental state of $P1x$, it is necessary to introduce two similar inferences to 8.1.8

7 [Bouquet1998]

8 We remember that the viewer's cognitive state about a character Px in a story, is the set of Px's mental attitudes at time Tx:

$$\begin{aligned}
&mev(Tx, bel(Spx, cE(Cevx, bel(Ex, Px)))), \\
&mev(Tx, bel(Spx, cE(Cevx, int(Ex, Px)))), \\
&mev(Tx, bel(Spx, cE(Cevx, goal(Ex, Px)))).
\end{aligned} \tag{8.1.6}$$

for the internal mental attitudes of $\mathsf{P1x}$ of intentions (int) and goals (goal), as described in 8.1.6[9] . Expressions of type:

$$\mathsf{mev(Tx, bel(Spx, diegeticMentalPersistence(P1))).\ \ person(P1).}$$

can be used to represent all types of diegetic mental persistence rules. While to represent the persistences of the properties of physical objects in the passage from one course of events to another, I will use the predicate:

$$\begin{array}{l}\mathsf{mev(Tx, bel(Spx, diegeticObjectPropertyPersistence(O1))).} \\ \mathsf{physical\_object(O1).}\end{array} \tag{8.1.8}$$

With a such formalism I can represent persistence rules that may vary in the story.

In the story *Life is wonderful*, George Bailey (James Stewart) enters in a new course of events counterfactual to the previous. In the latter course of events George wishes to come back to his previous life (in the course of the events he has left) – this desire can arise only because George remembers his previous life.

The main character Phil in *Groundhog Day* has the full awareness to live in a counterfactual context – this happens also in *Family Man*, in which Jack Campbel (Nicolas Cage) is uncertain if he likes his new life. In both films mentioned, George and Jack cannot desire to come back in the respective courses of events without remembering the events of their lives in those contexts.

We need to signal that in a story, the persistence rules can be valid for some characters, for others not. In *Groundhog Day*, for example, the protagonist has the memory of events, in the courses of events happened. Although this is not true for the other characters participating to the events in the following courses of alternative events of the story. For the existence of such phenomena in the stories has arisen a new term for the analysis of a movie, that has been denominated "personal time", concept it is used to characterize the time lived time by a character, in comparison with the times of the other characters.

Another example of conservation of the spectator's mental state is present in *Twelve monkey*, in which besides the character *Cole* – there are other char-

9 For a discussion on the cognitive persistence representation of characters and object properties, I have taken into account the content arguments presented in [Bouquet1998].

acters who remember what happen in the different courses of events – I am referring to the supervisors of the time travels, who decide the time of Cole's departure and returning, and control the position of other people that have been sent forward and back in time (by using sensors inserted in their molars).

Concerning the conservation of object properties, an example is yet given in *Twelve Monkey*, in which a bullet embedded in the protagonist's leg, travels together to this last one and not changes his structural property in the various passages of the courses of events.

In most of the films of travels in time, the characters that travel in time don't change their aspect (don't grow old, nor become young). In all the counterfactual stories, in which there isn't character's awareness to live in a counterfactual context (stories I have denominated with implicit counterfactuality), there is obviously a loss in memory in the passage among the counterfactual contexts.

8.2 MODELS OF COUNTERFACTUALITY

Typically the term ”counterfactual”[10] is used for those events that not really happen and that are considered as hypothetical alternatives to the real events. It seems clear that in the context of the couple movie-spectator, don't exist real events. There are only the false world of the film story and the viewer with his beliefs on the story events – all entities belonging to an context of fiction.

Typically a counterfactuality occurs in a story when the spectator believes an event Ex that happens in the diegesis is mutually exclusive with another event Ey already presented in the story. The refusal by the viewer to accept that Ex and Ey happen in the same course of events, forces him to assume that the events Ex and Ey belong to two alternative courses of events. In this case, what justifies the term "counterfactual" is not an external point of view, that

10 It exist an extensive literature about the notion of counterfactuality. In a field of researches that deal with formal models - I point out the R. Ferrario's research [Ferrario2003] on the counterfactuality, in which the counterfactual situations are modeled as a context. In the R. Ferrario's PhD thesis was taken as reference a formal theory on contextual reasoning ([Ghidini2001], [Serafini2002]).

(a) E11 - Helen at top the stairs of the metro (BEGINS THE FIRST COURSE OF EVENTS)

(b) E12 - Helen comes down the stairs

(c) E1x - Helen clashs with a passerby

(d) E1n - Helen does not take the metro

(e) E21 - Helen at top the stairs of the metro (BEGINS THE SECOND COURSE OF EVENTS)

(f) E22 - Helen comes down the stairs

(g) E2x - Helene avoids the bump with a passerby

(h) E2n - Helen takes the metro

Figure 8.1.2: Sliding Doors - two counterfactual course of events

can determine what is real and what it is not, but is the point of view of the spectator himself, who acts as arbiter and censor for recording two mutually exclusive events. A counterfactuality then exists between two events of fiction – both of which are not real. A counterfactual figure present in a story can be modeled through two courses of events $Cev1$ and $Cev2$, where in both the criterion of integrity is respected and where there are two events Ex and Ey, that cannot exist in a same course of events. It is possible to define an or-exclusive condition between two events $E1$ and $E2$ within an event course, through the inferences 8.2.1 and 8.2.2:

$$\begin{aligned}&\mathrm{mev}(Tx, \mathrm{bel}(Spx, cE(Cevx, \mathrm{xor}(E1, E2)))) \leftarrow\\&\ \mathrm{courseEvent}(Cvex),\\&\ \mathrm{mev}(Tx, \mathrm{bel}(Spx, cE(Cevx, E1))),\\&\ -\mathrm{mev}(Tx, \mathrm{bel}(Spx, cE(Cevx, E2))),\\&\ \mathrm{diegeticEvent}(E1),\\&\ \mathrm{diegeticEvent}(E2),\\&\ \mathrm{time}(Tx).\end{aligned} \tag{8.2.1}$$

$$\begin{aligned}&\mathrm{mev}(Tx, \mathrm{bel}(Spx, cE(Cevx, \mathrm{xor}(E1, E2)))) \leftarrow\\&\ \mathrm{courseEvent}(Cevx),\\&\ -\mathrm{mev}(Tx, \mathrm{bel}(Spx, cE(Cevx, E1))),\\&\ \mathrm{mev}(Tx, \mathrm{bel}(Spx, cE(Cevx, E2))),\\&\ \mathrm{diegeticEvent}(E1),\\&\ \mathrm{diegeticEvent}(E2),\\&\ \mathrm{time}(Tx).\end{aligned} \tag{8.2.2}$$

To define a condition of counterfactuality between two events, in addition to the condition of mutual exclusivity $\mathrm{xor}(E1, E2))$, it is necessary to insert a mental condition of the spectator where he believes that the two events $E1$ and $E2$ are homologous. This condition is true only if the components of events

$E1$ and $E2$ - the characters, the diegetic spaces and the diegetic intervals - are homologous. In other words the following inference must be true:

$$
\begin{array}{ll}
\multicolumn{2}{l}{mev(Tx, bel(Spx, homologousE(E1, E2))) \leftarrow} \\
\quad mev(Tx, bel(Spx, homologousP(Wo1, Wo2))), & \text{\%the characters Wo1 and Wo2,} \\
\quad mev(Tx, bel(Spx, homologousS(Wr1, Wr2))), & \text{\%the diegetic spaces Wr1 and Wr2,} \\
\quad mev(Tx, bel(Spx, homologousT(Wh1, Wh2))), & \text{\%the diegetic interval Wh1 and Wh2} \\
\quad mev(Tx, bel(Spx, cE(Cev1, E1))), & \text{\%are homologous} \\
\quad mev(Tx, bel(Spx, cE(Cev2, E2))), & \\
\quad mev(Tx, bel(Spx, cE(Cev1, when(E1, Wh1)))), & \\
\quad mev(Tx, bel(Spx, cE(Cev2, when(E2, Wh2)))), & \\
\quad mev(Tx, bel(Spx, cE(Cve1, where(E1, Wr1)))), & \\
\quad mev(Tx, bel(Spx, cE(Cve2, where(E2, Wr2)))), & \\
\quad mev(Tx, bel(Spx, cE(Cve1, who(E1, Wo1)))), & \\
\quad mev(Tx, bel(Spx, cE(Cve2, who(E2, Wo2)))), & \\
\quad notEq(E1, E2). & \\
\\
\multicolumn{2}{l}{notEq(E1, E2) : -diegeticEvent(E1), diegeticEvent(E2), E1! = E2.}
\end{array}
\tag{8.2.3}
$$

In *Groundhog Day* the viewer believes that the counterfactual events are homologous since: the same actor plays the character Phil and therefore has his homologous in all courses of event; the diegetic space is always the one relating to the hotel where Phil wakes up; and the time intervals are highlighted by a morning alarm that is activated every day at the same time. In *Sliding Doors* instead the viewer believes that the events of Helene who takes and loses the train are homologous since Helene is played by the same actress (the spectator believes that the two Helene are homologous): the diegetic space is always the same that of the subway station; the viewer believes that events occur on the same interval (they are homologous) because there is a gone back in time between the intervals of the story when Helen begins to come down the metro stairs.

We can define so a counterfactuality figure between two $E1$ and $E2$, as a relation of compatibility between two courses of events in which $E1$ and $E2$ result mutually exclusive and homologous:

$$
\begin{aligned}
& mev(Tx, bel(Spx, contr(E1, E2))) \leftarrow \\
& \ mev(Tx, bel(Spx, cE(Cve1, E1))), \\
& \ mev(Tx, bel(Spx, cE(Cve1, xor(E1, E2)))), \\
& \ mev(Tx, bel(Spx, cE(Cve2, homologousE(E1, E2)))), \\
& \ mev(Tx, bel(Spx, cE(Cve2, E2))), \\
& \ mev(Tx, bel(Spx, cE(Cve2, xor(E1, E2)))), \\
& \ courseEvent(Cve1), courseEvent(Cve2), Cve1! = Cve2.
\end{aligned}
\tag{8.2.4}
$$

I will call two courses of counterfactual events $Cev1$ and $Cev2$, if they possess at least a counterfactual figure between two events Ex and Ey belonging respectively to $Cev1$ and $Cev2$.

A character enters in a course of counterfactual events through different modalities that vary with well defined rules from story to story. Some frequent modalities of access to courses of counterfactual events, are reported in the table 6.

ACont1	The access to counterfactual course of events happens with specific reasons
ACont2	There is one tool that permit access to a counterfactual course of events
ACont3	It is described the mechanism that allows access to courses of events
ACont4	There is a character's intention of accessing to a context of life counterfactual
ACont5	The character can choice of accessing (or of exiting) to a counterfactual course of events
ACont6	The character has awareness of accessing to a counterfactual course of events

Table 6: Types of access to counterfactual courses of events in a story

CCont1	Preservation of the character's cognitive state when he passes to the new course of events
CCont2	Preservation of the properties of objects in the transition to a new course of events
CCont3	The character increases their abilities for each access to a new course of events

Table 7: Compatibility rules among counterfactual courses of events

8.2.1 Implicit counterfactuality

Stories such as *Sliding Doors*, *Blind Chance* and *Lola Rennt* contain counterfactual figures I have called implicit. In these figures it doesn't exist any enunciation of a character, extradiegetic voices or captions manifesting a counterfactuality – the spectator believes that in the story has been presented a new course of counterfactual events, only through the application of the inference that "if there exist two events that exclude each other, they have to belong to different (counterfactual) courses of events".

Generally the implicit counterfactual stories, have only the counterfactual figures as characterization – without having for example any compatibility rule among the courses of events[11]. The explanation lies in the fact that the implicit counterfactual figures are used to represent completely alternative stories, without having any relations with other courses of events. To reach a formal proposal of a cognitive model for implicit counterfactuality, I start by analyzing two sequences of the movie *Sliding Doors*, in which in figure 8.1.2 I show the still images. The first sequence is formed by the following events:

E11=Helen at top of the stairs in the metro
E12=Helen coming down the stairs
E1x=Helen clashs with a passerby
E1n=Helen does not take the metro

11 To be noted that (in principle) we cannot exclude that there could exist implicit counterfactual stories having compatibility relations among courses of events.

being $E1n$ a causal consequence of $Ex1$ – $bel(Spx, cause(Ex1, E1n))$. The second sequence is formed of the events:

$E21$=Helen at top of the stairs in the metro
$E22$=Helen coming down the stairs
$E2x$=Helene avoids the bump with a passerby
$E2n$=Helen takes the metro

being $E2n$ a causal consequence of $E2x$, as the spectator owns the cognitive rule: $bel(Spx, cause(E2x, E2n))$. The first and second sequences are separated by a reverse movie that explicitly signals to the spectator that the story has gone back in time when Helen begins to come down the metro stairs. To give indications to the spectator about the existence of a counterfactuality, the reverse movie doesn't give any contribute – a temporal coming back could be reported in the story to signal to the spectator, for example, that I wish to show in a same temporal interval some story events from another point of view (see the movie *Before the Devil Knows You're Dead*). The two sequences of *Sliding Doors* I have taken into account are two macro events $Mev1$ e $Mev2$ with a reverse movie (Rm) functioning as break:

$Mev1 ::= E11, E12, E1x, E1n$
Rm
$Mev2 ::= E21, E22, E2x, E2n$

In the example of the metro in *Sliding Doors*, the events $E21$ (Helen at the top of the stairs in the metro), $E22$ (Helen coming down the stairs) belonging to the second course of events $Mve2$, are a repetition of $E11$, $E12$ seen in $Mve1$, in which the spectator believes there is a repetition of events:

$bel(Spx, rep(E11, E21))$
$bel(Spx, rep(E12, E22))$

These beliefs lead the spectator to believe that in the story some events are shown, that are (exact) repetitions of other events previously seen (no matter if shown from other point of view). But not all the events are repeated, only when presenting $Ex2$ (Helen bumping into a pedestrian), the spectator notice a situation of incongruity – that is in a same story there are two events in which

”Helen bumps a pedestrian who is climbing the stairs” and at the same time ”Helen avoids bumping a pedestrian while descending the stairs”. It results that the spectator to eliminate this incongruity believes that the two macro events $Mev1$ and $Mev2$ belong to two separated courses of events.

A counterfactual implicit story is characterized by three phases (see figure 8.2.1): a generation of a spectator's belief on repeated events in the story, the arising of an incongruity and the elimination of the latter with the consequent spectator's belief to be in presence of a counterfactuality.

In a first phase it is proposed to the spectator an initial sequence of events:

$$sinit ::= E11, E12 \ldots E1n, E21, E22 \ldots E2n$$

In this first phase the spectator recognizes a repetition of some events (at least one)[12]: $E21$-$E2n$ is a repetition of $E11$-$E1n$ if Spx believes that: $E21$ is a repetition of $E11$; $E22$ is a repetition of $E12$; $E11$ and $E12$ visually are contiguous; $E21$ and $E22$ visually are contiguous; $E2m$ is a repetition of $E1m$; $E2n$ is a repetition of $E1n$; $E1m$ and $E1n$ visually are contiguous; and $E1n$, $E2n$ visually are contiguous. In a formal way:

$$\begin{aligned}
&mev(Tx, bel(Spx, repMe([E11, E1n], [E21, E2n]))) \leftarrow \\
&\quad mev(Tx, bel(Spx, rep(E11, E21))), \\
&\quad mev(Tx, bel(Spx, rep(E12, E22))), \\
&\quad mev(Tx, bel(Spx, visContigue(E11, E12))), \\
&\quad mev(Tx, bel(Spx, visContigue(E21, E22))), \\
&\quad mev(Tx, bel(Spx, rep(E1m, E2m))), \\
&\quad mev(Tx, bel(Spx, rep(E1n, E2n))), \\
&\quad mev(Tx, bel(Spx, visContigue(E1m, E1n))), \\
&\quad mev(Tx, bel(Spx, visContigue(E1n, E2n))).
\end{aligned} \tag{8.2.5}$$

With the term $bel(Spx, repMe([E11, E1n], [E21, E2n]))$ I have indicated the spectator's belief on the repetition of two sequences ($[E11, E1n]$, $[E21, E2n]$) according to the definition 8.2.5.

In the second phase the spectator detects an incongruity corresponding to two events $E1x$, $E2x$. These events are believed to happen visually contiguous to the latest events $E1n$ and $E2n$ of the sequences $E11, E1n$, $E21, E2n$. The events $E1x$, $E2x$ exhibit two actions that exclude each other (in *Sliding Doors*

12 For the beliefs of the repetition of events ($mev(Tx, bel(Spx, rep(Ex, Ey)))$) I consider the criteria of the repetition of events, presented in chapter 5

example, Helen can't bump and at the same time can't avoid bumping the pedestrian) – $mev(Tx, bel(Spx, cE(Cvex, xor(E1x, E2x))))$ holds[13]. This condition generates a mental incongruity of the spectator, regulated by the inference::

$$\begin{aligned}&mev(Tx, addBel(bel(Spx, cE(Cvex, incongruity(E1x, E2x))))) \leftarrow \\ &\quad mev(Tx, bel(Spx, sameCe(E1x, E2x))), \\ &\quad mev(Tx, bel(Spx, cE(Cvex, xor(E1x, E2x)))), \\ &\quad courseEvent(Cvex).\end{aligned} \tag{8.2.6}$$

In summary, two mutually exclusive events can not belong to the same course of events. This incongruity constitutes a spectator's rule that I believe arises **for induction from the real life**[14] – in this rule the events belonging to a same story having the same characters, spaces and intervals of happening, have to be *compatible* among themselves, that is they can't exclude each other – if it occurs then an incongruity in the spectator's cognitive space is created.

In a third phase the spectator reestablishes the congruity (restores its cognitive status), by eliminating from the cognitive state the condition that the events $E1x$ and $E2x$ belong to a same course of events($sameCe(E1x, E2x)$) . Formally:

$$\begin{aligned}&mev(Tx, remBel(bel(Spx, sameCe(E1x, E2x)))) \leftarrow \\ &\quad mev(Tx, bel(Spx, cE(Cve1, incongruity(E1x, E2x)))), \\ &\quad mev(Tx, bel(Spx, visContigue(E1n, E1x))), \\ &\quad mev(Tx, bel(Spx, visContigue(E2n, E2x))), \\ &\quad mev(Tx, bel(Spx, rip([E11, E1n], [E21, E2n]))), \\ &\quad mev(Tx, bel(Spx, cE(Cve1, E1x))), mev(Tx, bel(Spx, cE(Cve2, E2x))).\end{aligned} \tag{8.2.7}$$

13 The spectator has the following rule:

$$\begin{aligned}&mev(Tx, bel(Spx, cE(Cvex, xor(E1x, E2x)))) \leftarrow \\ &\quad mev(Tx, bel(Spx, cE(Cvex, xor(A1x, B1x)))), \\ &\quad mev(Tx, bel(Spx, cE(Cvex, what(E1x, A1x)))), \\ &\quad mev(Tx, bel(Spx, cE(Cvex, what(E2x, A2x)))), \\ &\quad E1x! = E2x, diegeticEvent(E1x), diegeticEvent(E2x).\end{aligned}$$

14 The reason I used this term is that the learning of many cognitive rules the spectator adopts for the comprehension of the story, is not because they are uttered in the filmic text, but because the spectator owns already these rules and applies it in his daily experience

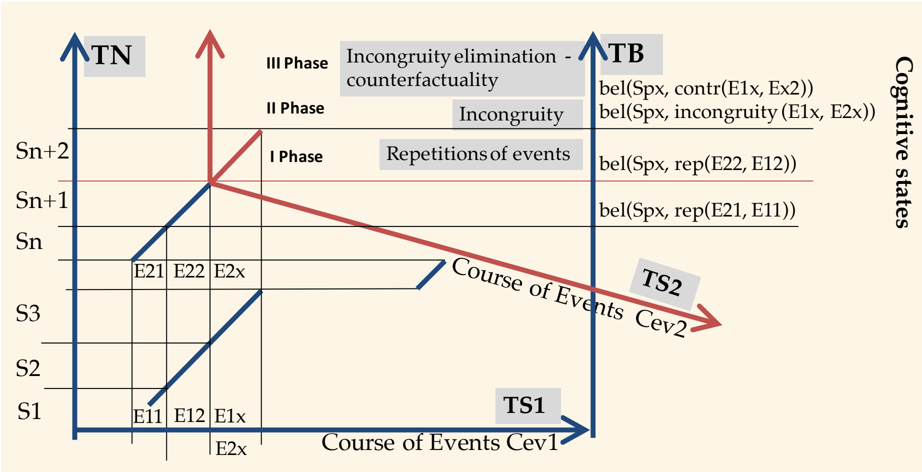


Figure 8.2.1: Model for the implicit counterfactuality represented through a TN -TS -TB diagram

The condition $mev(Tx, bel(Spx, cE(Cvex, xor(E1x, E2x))))$ persists in the mental state of the spectator together with the condition that $E1x$ and $E2x$ belong to two different courses of events, this cause in the spectator a mental state of counterfactuality ($mev(Tx, bel(Spx, contr(E1x, E2x)))$) as the inference 8.2.4 is valid.

The non-belonging conditions for the same course and the spectator's acceptance that there is a counterfactuality between the two events $E1x$, $E2x$, leads the spectator to eliminate the mental component of counterfactuality as follows:

$$\begin{aligned}&mev(Tx, remBel(bel(Spx, incongruity(E1x, E2x))) \leftarrow\\&\quad mev(Tx, not\ bel(Spx, sameCe(E1x, E2x))),\\&\quad mev(Tx, bel(Spx, incongruity(E1x, E2x))),\\&\quad mev(Tx, bel(Spx, contr(E1x, E2x))).\end{aligned} \tag{8.2.8}$$

The movie stories *Lola Rennt*[15] and *Blind Chance* are implicit counterfactual stories, with the particularity to have more counterfactual courses of events. For such stories the model above proposed in the scheme 8.2.1 is extended by applying the inferences of the three phases presented (repetition, incongruity and reconstruction) and every pair of courses of events (counterfactual). The

15 [LolaRennt]

Figure 8.2.2: *Blind Chance*

stories with more temporal branches, often present more figures of counterfactuality relating to a same event of the story.

Blind Chance[16]presents a variation of the structural scheme reported in figure 8.2.1. The story has three courses of events represented in figure 8.2.3 (in figure 8.2.2 it is reported the first course of events of the story, in which Witek avoids bumping a person who is drinking at the station bar, and tries to catch the train handle).

The specificity of the counterfactuality of *Blind Chance* is in the end of the third story of the movie, in occasion of a return back of the story, that connects itself to an event presented before opening titles – the event regards Witek's tearing shout in an plane – the spectator will become aware in the latter sequence, that the plane is precipitating after the explosion. This coming back in time doesn't break the author's detach about the not showing of a preference among the three courses of events in which Witek is protagonist: (1)

16 The structural scheme of *Sliding Doors* is very similar to the one of the movie *Blind Chance* [BlindChance] by K. Kieslowski. This latest is a movie that has been commercialized before *Sliding Doors* – and it is clear it has been influenced by it, or inspired by it. In both stories there is someone who in two different courses of events hinders or doesn't hinder the protagonist, in both stories there is a train (caught or do not caught by main character) and it is just this kind of event that creates a counterfactuality between the two stories.

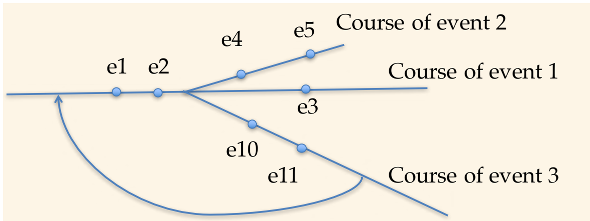


Figure 8.2.3: Counterfactual diagram of *Blind Chance*

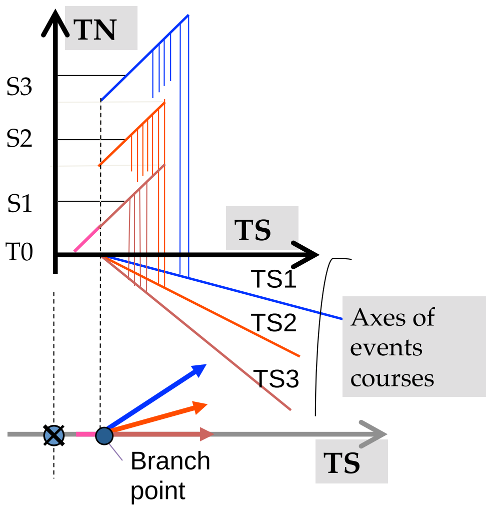


Figure 8.2.4: The graphic construction of a branch point

the party entrance, (2) being part of the catholic opposition (3) the sustaining the independent role. The separation and the symmetry are of fundamental importance for the movie – by closing the third story with a going back to the common initial part, the spectator could have been tempted to interpret the story with a preference towards choosing (3). Here Kielowsky's formal accuracy is always extreme: he poses the initial scene of the screaming before opening titles, making it independent from the initial prologue, common to the three stories. With this device, the scene of the screaming belongs only to the third story, the prologue remains common to the three cases lived by Witek – and the game is made – the symmetry is untouched and no story is preferred among the others. Branch lines of the type shown in the graph of figure 8.2.3 are obtained starting from the representation contained in the plan TN-TS (see figure 8.2.4), in the following way:

1. each course of events (that happens in correspondence of sequences S1 and S2 S3) is represented with different types of lines. For each new course of events we execute a rotation (a few degrees) of each lines around the axis TN (figure 8.2.4);
2. you rotate the plan TN tr TS of 90 degrees around the axis TS and you draw the projections of the lines on the new plan.

8.2.2 Explicit counterfactuality

In the implicit counterfactuality forms, the spectator's belief about mutually exclusivity between two events is *inferred* by the spectator himself. Instead, in the explicit stories the counterfactuality is assumed by the spectator through specific and explicit enunciations present on the filmic text – these utterances suggest to the spectator that two or more events are collocated in two different courses of events. The belief of explicit counterfactuality, in this way, do not require that there is a belief of incongruity in the viewer's mental state.

The explicit counterfactuality is represented in the filmic text in two ways:

(a) through a character's verbal declaration of a counterfactuality, or even it can be inferred by a character's behaviour that manifests of living in a course of counterfactual events (internal explicit counterfactual form);
(b) through an extradiegetical voice that enunciates a counterfactual event (external explicit counterfactual form)

An explicit counterfactuality is present in the movies as *It's a Wonderful Life*[17], *Groundhog Day*[18] and *Family Man*[19]. In this stories there is a character's awareness of living in an alternative course of events, and it exists a rule of compatibility that demands that there is the character's remembering of events present in other courses of events – but almost always, there isn't a persistence of properties of the objects.

17 [ItsaWonderfulLife]
18 [GroundhogDay]
19 *The Family Man* [TheFamilyMan] is a movie directed by Brett Ratner, and performed by Nicolas Cage and Téa Leoni.

INTERNAL EXPLICIT COUNTERFACTUAL FORM. In this form of counterfactuality a character lives with the awareness of being in a new course of events, alternative to the one he was living. In such case – there are explicit or inferable events in the diegesis, in which he is aware of being in an alternative course. Famous movies possessing counterfactual figures of such kind are: *It's a Wonderful Life*, *Groundhog Day* and *The Family Man*. In such movies a character of the story is conscious of the incongruity ($\mathtt{bel}(\mathtt{Spx}, \mathtt{bel}(\mathtt{Px}, \mathtt{E1x\ xor\ E2x})))$ – often this is shown through embarrassment or contrariety, of living in an alternative course of events. It is simple to verify that cognitive states leading to the record in the spectator of an explicit counterfactuality are similar to the ones for the implicit counterfactuality. In some cases we can affirm that the first are cognitively less complex, as the counterfactuality for these kind of stories is enunciated in the story (it is explicit).

The movie *It's a Wonderful Life* is one of the first example of movies to present an explicit counterfactuality. In *It's a Wonderful Life* George Bailey (James Stewart) is a happily married young, who has children and dedicates his time to the service to others. He is in a crisis of depression – due to the failure of an economic firm that was closed – his heart is full of frustrations. George decides to throw himself into the river, but in the moment he is doing this, he is stopped by an angel, who brings him in a course of alternative event. George is able to see, in this new course of event, how it would have been his life without his family, without his sons and his friends. At this point George desires to go back to the life he had previously, in other words, he want to go back to the initial course of events.

Let's characterizes in a synthesis this story. George Bailey ($\mathtt{george1}$) in a first course of events is married ($\mathtt{e1}$) and has sons ($e2$), in a second course $\mathtt{george2}$ (homologous of $\mathtt{george1}$) is not married ($\mathtt{not\ e1}$) and hasn't got children ($\mathtt{not\ e2}$). This situation is transformed in an inner conflict for $\mathtt{george2}$ – is not wedded ($\mathtt{e1}$), but among his desires (goal) there is the one of being married $\mathtt{bel}(\mathtt{spx}, \mathtt{goal}(\mathtt{george2}, \mathtt{e1})$. In a formal manner:

$$\mathtt{not\ mev}(\mathtt{tx}, \mathtt{bel}(\mathtt{spx}, \mathtt{cE}(\mathtt{cve2}, \mathtt{bel}(\mathtt{george2}, \mathtt{e1})))).$$
$$\mathtt{mev}(\mathtt{tx}, \mathtt{bel}(\mathtt{spx}, \mathtt{cE}(\mathtt{cve2}, \mathtt{goal}(\mathtt{george2}, \mathtt{e1})))).$$

Figure 8.2.5: Jack Campbell (Nicholas Cage) – in *The Family Man*

We can observe that George's desire arises above all by the happy remembrance of the wedded life he had in the first course of events. In this story so, it exists a persistence of events, when accessing to new course of events. Generally the explicit counterfactuality always lead to a persistence (also if in different grades) of knowledge among the alternative courses of events. This is clear to the spectator as the protagonist in these stories has a perception, that is clearly represented (staged) in the diegesis. *The Family Man* is the story of Jack Campbell (Nicholas Cage), a Wall Street successful man, with women at his feet, who possesses a Ferrari and a penthouse. On Christmas eve, Jack meets a man with particular powers, who obliges him to see how could have been his life if he had preferred family and love to his carrier. The following day is Christmas – Jack wakes up in a bed that is not his – he is married with Kate, the girl he had left for a job, far from his town. In this new life Jack has two children, and lives by selling pneumatics in his father in law's firm. After an initial protest, he understands that the one of a successful manager was not the life he had desired. In *The Family Man* the protagonist has a cognitive path starting by his lack in desire to live in a world alternative, to the one he is living – the status is to be single and don't be married. He then passes to an intermediate state of indecision (he likes having a family, but he has to renounce to his carrier). In the end, he changes his desire and accepts the alternative course of events that has been proposed him, that is, that of being married. In all these transformations, the counterfactuality is explicit, and it is expressed in the filmic staging through Jack's emotions (the protagonist of the story).

A film similar to *Family Man*, but having a more complex structure than this latter, is *Me Myself I*[20] although this story has some typical features of stories on the reality levels too. In fact in *Me Myself I* the compatibility rules among the courses of events establishes a persistence among mental states of the protagonist - Pamela when enters in the second course of events ($Cve2$) remembers what happened in the first course of events ($Cve1$) improving its behavior in the family where she lives. Similarly when from second course of events she returns to the first course and uses the rules of life that has learned over the events ($Cve2$) in which is married, and has some sons.

Last analysis suggests that among the explicit counterfactual figures, there is an interesting category in which occurs an increase of the abilities of a character, in the move from a course of the event to another. As I have already reported, the counterfactual explicit form involves the persistence of the remembrance of a character.

In the movie *Groundhog Day*, it is not valid the rule of compatibility among courses of events establishing the persistence of physical object properties. This characteristic is a rule of compatibility, also if has a form of a constraint is expressed very clearly in the episode in which Phil, the night before going to bed, breaks a pencil, and put it on his night table – the following day he finds the pencil intact.

There is in the story a mental persistence of Phil that remembers about what happened the day before – in this way Phil knows in advance the events that are going to happen, he avoids entering with feet in a pit of water (as he knows the pit of water position), he has success in stealing money from a van

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20 *Me Myself I* [MeMyselfI] is a 2000 Australian film directed by Pip Karmel. The film was released the same year as *The Family Man* for which is not possible to establish if one has influenced the other. The story of *Me Myself I* is composed of two alternative courses of events. In a first course ($Cve1$) Pamela Drury (Pamela1) is single and works as a journalist writing challenging articles on a magazine. She secretly wishes to be married and have children. Pamela1 is hit by a car while crossing the street. Such event projects Pamela1 in an alternate universe ($Cve2$) in which, with the name of Pamela Dickson (Pamela2), she married Robert 13 years earlier. In $Cve2$ Pamela2 has three sons, and also in such life context, Pamela2 inquires herself if the her life choice to be wife and mother is that right.

(as already knows in advanced the guards' actions of the armored car) and so on.

In *Groundhog Day* the counterfactualities are manifested in every new day, in which Phil wakes up and in the same calendar day. The events of the falling,

Figure 8.2.6: *Groundhog Day* – Phil's awakening

and not falling, in a pit of iced water, are part of an counterfactuality example existing between two courses of events. In fact in a same course of events, the events of the falling into a pit of water, and the not fall, are mutually exclusive:

$$\mathsf{mev}(\mathsf{tx}, \mathsf{bel}(\mathsf{spx}, \mathsf{cE}(\mathsf{cve1}, \mathsf{xor}(\mathsf{fallIn}(\mathsf{phil}, \mathsf{pit}), \mathsf{jump}(\mathsf{phil}, \mathsf{pit}))))).$$

While the two events in the different courses of events $\mathsf{cve1}$ and $\mathsf{cve2}$ can exist:

$$\begin{aligned}
&\mathsf{mev}(\mathsf{tx}, \mathsf{bel}(\mathsf{spx}, \mathsf{cE}(\mathsf{cve1}, \mathsf{what}(\mathsf{e1}, \mathsf{fallIn}(\mathsf{phil}_1, \mathsf{pit}))))).\\
&\mathsf{mev}(\mathsf{tx}, \mathsf{bel}(\mathsf{spx}, \mathsf{cE}(\mathsf{cve2}, \mathsf{what}(\mathsf{e2}, \mathsf{jump}(\mathsf{phil}_2, \mathsf{pit}))))).\\
&\mathsf{mev}(\mathsf{tx}, \mathsf{bel}(\mathsf{spx}, \mathsf{cE}(\mathsf{cve2}, \mathsf{homologous}(\mathsf{phil}_1, \mathsf{phil}_2))))).
\end{aligned}$$

As consequence of the mental state (remembrance) persistence, Phil Connors increases in each course of events his knowing and capacities – every time he moves in a new course of events, he uses the abilities acquired in the previous courses of events. Among a course of events and another, Phil learns to play the piano. Phil's skills of playing this instrument, grows up through the following causal chain (there is a level of skill X_N for each corresponding course of events Cve_N):

$$
\begin{aligned}
&mev(Tx, bel(Spx, cE(Cve_{N+1}, propEv(E_{N+1}, prop(pianisticSkill, Py, X_{N+1}))))) \leftarrow \\
&\quad mev(Tx, bel(Spx, cE(Cve_N, E_N))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_N, who(E_N, Px)))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_{N+1}, E_{N+1}))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_N, propEv(E_N, prop(pianisticSkill, Px, X_N))))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_N, pianisticSkill(Px, X_N)))), \\
&\quad mev(Tx, bel(spx, cE(Cve_{N+1}, homologous(Py, Px)))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_N, what(E_N, accessContr(Cve_N, Cve_{N+1}, Px))))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_{N+1}, what(E_{N+1}, learn(Py, piano, X_N, X_{N+1}))))), \\
&\quad mev(Tx, bel(Spx, cE(Cve_{N+1}, who(E_{N+1}, Py)))).
\end{aligned}
$$

In *Groundhog Day* we can observe for the aspect regarding Phil's learning, between a lesson and another (a course of events and another) there is not a counterfactuality, but an increment of knowledge. In *Edge of Tomorrow*[21] there are numerous explicit conterfactualities presenting the particularity of having a variable modality of access to the counterfactual courses of events, according to the particular situation, in which the protagonist finds himself before entering the course of events. The rule it is applied at the moment that a person enters in contact with an alien's blood when he is dying. If this occurs, the person finds himself back in time, in the previous day (in a counterfactual course of events). While, if someone does not have an alien's blood in his body (as it happens in the story when the protagonist undergoes a transfusion), he is not able to make the temporal reset to the previous day. The access modality to the course of events, so it is in function of the particular situation in which a character comes out from a course of events.

The counterfactual forms present both in *Groundhog Day* and *Edge of Tomorrow* have the particularity to collocate the courses of alternative events back in time to the previous day, the respective protagonists have persistence of their mental states and remember so, what happened the day before. In this way they have the capacity to know before other characters what is going to happen.

21 *Edge of Tomorrow* [EdgeTomorrow] also known with the title "Live. Die. Repeat" is a recent controfactual film, starring Tom Cruise, Emily Blunt, Bill Paxton and Brendan Gleeson

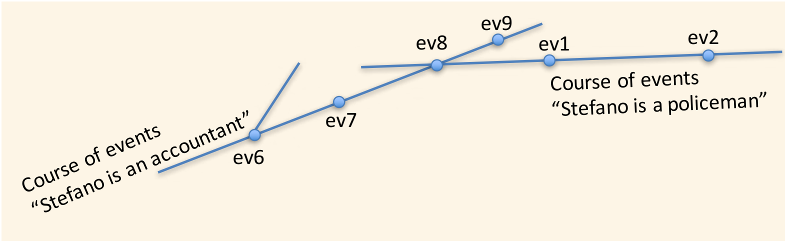

Figure 8.2.7: *Stefano Quantestorie* – Counterfactuality with multiple points of branching

EXTERNAL EXPLICIT COUNTERFACTUAL FORM. A form of external explicit counterfactuality is realized by a narrative extradiegetic voice, that introduces, or makes a comments each time a character enters into a course of events. An example of this controfactuality kind is present in the movie *Stefano Quantestorie*, in which an extradiegetic voice (Stefano's mother, that is not the one of a character present in the scene) declares, in some narration moments, that Stefano could have made an alternative course in his life, to the one that the telling he is showing in that moment. In this case, also if the counterfactuality is explicit, the narrative voice is not the one of who makes the actions – there is not the awareness by the character to live in that alternative dimension. *Stefano Quantestorie* is a story composed of various courses of events, in which often the counterfactuality manifests itself during a course of events that is already counterfactual to another course of events. In figure 8.2.7 are reported courses of alternative events in *Stefano Quantestorie*, after the third counterfactuality has been presented.

8.3 PERSONAL TIME

I will consider a notion of personal time related to all aspects of events perceived by a character Px (succession, duration and perspective of a event). In particular I will take as a reference in my discussion the definitions presented in section 2.13. For the argumentations present in this paragraph, I have chosen three entities that I report again in following group of expressions:

$$\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{when}(Ex, \mathit{on}([Td1, Td2]))))) \tag{8.3.1a}$$
$$\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{dur}(Ex, Dx)))) \tag{8.3.1b}$$
$$\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{nowTd}(Tdy)))) \tag{8.3.1c}$$

The three beliefs 8.3.1 can be achieved by the spectator through various mental conditions which varies from one story to another. It is common to all the inferences of this kind that exists a spectator's belief on a character's perception on a instant of time (component 8.3.1c) (character's belief on the current time) or a temporal duration $\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{dur}(Ex, Dx))))$ (*character's belief on the time that passes*). These mental states are acquired from spectator by three main manners: Px announces that he is aware of the current chronological time Tx in which he lives; Px observes a time on a clock shown in the diegesis, or Px knows a temporal instant or duration from the words of another character.

I report a rule example of the type just described: the spectator Spx believes that Px believes Tdy is the present time if Spx believes that Px perceives the time Tdy, and believes that Tdy is a (diegetic) chronological time. Formally:

$$\begin{aligned}&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{nowTd}(Tdy)))) \leftarrow\\ &\ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{chronologicalTime}(Tdy)))),\\ &\ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{perc}(Px, Tdy))).\end{aligned} \tag{8.3.2}$$

Two spectator's beliefs on two chronological time are sufficient conditions (see equation 8.3.3) for constructing a character's belief on a time duration - $\mathit{mev}(Tx, \mathit{bel}(Spx(Ex, Dx)))$ - or even on (explicit) time interval ($[Td1, Td2]$):

$$\begin{aligned}&\mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{when}(Ex, \mathit{on}([Td1, Td2]))))) \leftarrow\\ &\ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{chronologicalTime}(Td1)))),\\ &\ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{bel}(Px, \mathit{chronologicalTime}(Td2)))),\\ &\ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{perc}(Px, Td1))),\\ &\ \mathit{mev}(Tx, \mathit{bel}(Spx, \mathit{perc}(Px, Td2))),\\ &\ \mathit{macroEvent}(Ex).\end{aligned} \tag{8.3.3}$$

A personal time definition can then be constructed through the three temporal aspects reported in 8.3.1. A personal time happens in a story when two events $E1$ and $E2$ are believed to be the same entity by two (or more than two) characters and have at least one different aspect (event time, duration and present time).

I report spectator's inference relative to the personal time of two characters $\mathsf{P1}$ and $\mathsf{P2}$ that respect the definition just given:

$$\begin{aligned}
&mev(Tx, bel(Spx, personalTime(P1, P2, D1, D2))) \leftarrow \\
&\; mev(Tx, bel(Spx, bel(P1, dur(E1, D1)))), \\
&\; mev(Tx, bel(Spx, bel(P2, dur(E2, D2)))), \\
&\; mev(Tx, bel(Spx, bel(P1, E1))), mev(Tx, bel(Spx, bel(P2, E2))), \\
&\; mev(Tx, bel(Spx, sameE(E1, E2))), \\
&\; not\ mev(Tx, bel(Spx, sameDur(D1, D2))).
\end{aligned} \tag{8.3.4}$$

It taking as reference the inference 8.3.4 we can say that a Personal Time relationship does not intrinsically involves a single character in a story, but it must defined through at least two characters. It even emerges that the presence of a personal time in a film story does necessarily require that the spectator has a direct belief about duration time. The spectator only annotates that exists a different duration on a same event ($bel(Spx, same(E1, E2))$ in $\mathsf{P1}$'s and $\mathsf{P2}$'s beliefs.

It is obvious that a personal time may be of interest to more than one action and interval, and that definition 8.3.4, can be extended to such situations present in a story

A well-known example of Personal Time is present in *Groundhog Day* where the protagonist Phil, in a same period of time (a day) lives different experiences. In a time interval of several days there are "or-exclusive" pairs and series of events linked by causal relationships, such as those that determine Phil's ability to learn how to play the piano. For other characters of the story the memory of the experiences is reseted at the end of the day. The analysis from the personal time point of view, presents the following characteristics:

1. within the same day all events of the homologues $Phil_i$ and other characters share the order and durations of the events expressed by the 8.3.3 and 8.3.1b;
2. within the same day and over several days Phil (all homologues $phil_i$) and the other characters share the same chronological time diegetic expressed by 8.3.1c;
3. on a time span of several days, the duration of Phil's personal expression expressed by 8.3.3 is greater than that of other characters. Since

there is a persistence of Phil's mental events, as the ultimate effect of the existence of homologous Phil ($\mathtt{phil}_1$, $\mathtt{phil}_2$,.., $\mathtt{phil}_n$), the viewer considers the set $\mathtt{phil}_i$ as a single character (Phil). In the mind of the latter, the spectator believes that experiences accumulate. In this sense Phil is a witness of the various events occurring in the alternative courses of events, and lives his experience in a dilated time compared to the other characters. In qualitative terms we can say mental time durations of Phil's events are not equal to that lived by other characters in the story;

4. there is an incongruity as the chronological diegetic time of the story is not incremented, while there exists a sequence of mental times of Phil t1, t2, tn, that are caused by the accumulation of events, which are sequentially arranged for the existence of causal relationships among them. Phil's mental times are thus symbolic times $\mathtt{t1, t2, \ldots, tn}$ are not matched with the diegetic times of the story occurring in a single day;
5. another incongruity occurs in correspondence of resetting the mental time of other non-protagonists characters. While the incongruity described above occurs for a dilatation of Phil's mental time, characters' mental time is contracted, being divided into homologous mental intervals that are collocated on the same day.

Personal Time topic would probably require a presentation in a cross section concerning various typology of stories, but this would have required an expensive modification of the order of arguments exposure of this book. Personal time is a notion existing not only in the counterfactual stories but also in other movie categories, such as time travels and levels of realities. Characters who travel over time, and those who enter reality levels have always a number of beliefs that are not proportional to that of other homologous characters. This is due to the fact that in most cases in these stories there is a persistence in the mental state of the story protagonist, while for others characters this does not happen.

In general, stories in which is present a personal time can be modeled through the following entities:

1. a set L_i of event courses for each access to a level of reality, temporal space or counterfactual course;

2. a set of P_x labels for each homologous character existing in an event course;
3. a rule of compatibility for mental persistence for a character of the story (usually for the persistence of homologue characters associated to the protagonist);
4. an incongruity rule represented according to the different personal times of characters - it is obvious that to represent this rule we must first formalize that the rule of common sense is violated and that determines viewer's mental incongruity;
5. a possible (if there is) rule of restoring congruity

According to the scheme so I think that personal time regards stories where are present several courses of events, and where there is a mental persistence rule of a character.

In literature[22] [Pezzotta2011] and [Pezzotta2014] have been labelled some narratives as stories having a Personal Time. In my opinion such stories do not seem to involve a mental time attributed by the spectator to a character in the story. I take in consideration in particular the story of *The Curious Case of Benjamin Button*. There are no rules such as the one in 8.3.4 leading to a belief on Benjamin's awareness (or also of the spectator) of having a Personal Time. The intervals, the duration and Benjamin's current time are the same as other characters in the story, for example the girlfriend and the woman who raised him. For these reasons I believe that this story should not be labeled as a story having a Personal Time.

I believe that a story like *The Curious Case of Benjamin Button*[23] can be modeled, without using the notion of Personal Time, as follows:

- there is a spectator's belief regarding Benjamin's anagraphic age

$$\mathsf{bel}(Spx,,\mathsf{prop}(anagraphicAge,B,aAge))$$

- there is a spectator's belief related to Benjamin's biological age

$$\mathsf{bel}(Spx,,\mathsf{prop}(biologicalAge,B,bAge))$$

22 I refer to the articles of E. Pezzotta

23 *The Curious Case of Benjamin Button* [CurCaseBenB] is directed by David Fincher. The film stars are Brad Pitt as a man who ages in reverse, Cate Blanchett as the love interest throughout his life, and Taraji P. Henson as the woman who raised him.

- there is an incongruity as there is not correct common sense relation (ccsRel) between anagraphic and biological age:

$$\begin{array}{l} mev(Tx, incongruity(aAge, bAge)) \leftarrow \\ \quad mev(Tx, bel(Spx, prop(anagraphicAge, B, aAge))), \\ \quad mev(Tx, bel(Spx, prop(biologicAge, B, bAge))), \\ \quad not\ mev(Tx, bel(Spx, ccsRel(aAge, bAge))). \end{array} \tag{8.3.5}$$

  being valid the following common sense rule:

$$\begin{array}{l} mev(Tx, bel(Spx, ccsRel(aAge, bAge))) \leftarrow \\ \quad mev(Tx, bel(Spx, prop(anagraphicAge, B, aAge))), \\ \quad mev(Tx, bel(Spx, prop(biologicAge, B, bAge))), \\ \quad mev(Tx, bel(Spx, increaseTime(aAge))), \\ \quad mev(Tx, bel(Spx, increaseTime(bAge))). \end{array} \tag{8.3.6}$$

- the incongruity can not be eliminated, the implications of rules 8.3.5 and 8.3.6 remain valid together with the fictional rule 8.3.7 which states that when Benjamin's biological age increases his biological age decreases:

$$\begin{array}{l} mev(Tx, bel(Spx, decreaseTime(bAge))) \leftarrow \\ \quad mev(Tx, bel(Spx, prop(anagraphicAge, B, aAge))), \\ \quad mev(Tx, bel(Spx, prop(biologicAge, B, bAge))), \\ \quad mev(Tx, bel(Spx, increaseTime(aAge))). \end{array} \tag{8.3.7}$$

In many film stories, the personal time concerns the sequential aspect of time and duration. There are films where personal time is also involved in the temporal perspective. This is the case of "The Lake House", where although the characters share the same duration of time in the two course of events, they do not share the same chronological instant and live their life in two temporal contexts whose distance is two years. This film will be analyzed in detail in the section 8.5.

8.4 MODELS OF TIME TRAVELS

If a spectator's counterfactual belief arises from the impossibility of placing two mutually exclusive events on the same course of events, the spectator's belief that is possible a time travel, and the consequent temporal branching borns from the spectator's acceptance that there may be two or more courses of events where the events can be placed – an acceptance that is caused by the scientific explanations provided in the filmic text, leading the spectator to believe that under certain conditions a such time travel is possibile.

Another way leading the spectator to believe that a time travel is possible, is scientific knowledge (of a fictional nature) acquired by the spectator itself through visions of movies previously seen.

Often the director of the film assumes motivations as that just described, in the cases in which does not provide the scientific explanations for which a time travel occurs in a story.

ACCESS RULES FOR TEMPORAL COURSES OF EVENTS. Also the stories in which are present time travels have courses of events as basic structures, and in every course of story events, the criteria of integrity are respected. The starting of a course of events happens after one or more characters of the story make a time travel – when it happens in the spectator's mind you create a belief relating to an event course change, in the manner described by the inference 8.1.3, where one of possible definition of spectator's belief on a time travel is the following:

$$\begin{aligned}&mev(Tx, bel(Spx, what(E3, timeTravel(A3)))) \leftarrow\\&\ complexEvent(E3),\\&\ mev(Tx, bel(Spx, E1)),\\&\ mev(Tx, bel(Spx, E2)),\\&\ mev(Tx, bel(Spx, what(E1, departTimeTravel(A1)))),\\&\ mev(Tx, bel(Spx, what(E2, arriveTimeTravel(A2)))),\\&\ union(A3, A1, A2).\end{aligned} \tag{8.4.1}$$

The same conditions of rule 8.4.1 bring also to the conclusion that a participant $P2x$ is homologous to the participant $P1x$. (inference 8.4.2)

The filmic enunciation of a time travel is almost always explicit – before the travel happens, the spectator possesses all the motivations of the travel and the knowledge of the physical laws (true or false that they could be) to explain that the travel is possible.

A specific characteristic of this narrative category consist in a description about of the instrument that allows the temporal transport. The latter is almost always given.

The ways with which a character enters in a course of event through a time travel, vary from story to story – in the table 6 I report the basic attributes describing the more frequent kinds of access to courses of events occurring through a time travel.

$$\begin{aligned}&\mathit{mev}(Tx, bel(Spx, cE(Cev2, homologousP(P1x, P2x)))) \leftarrow\\ &\quad \mathit{mev}(Tx, bel(Spx, cE(Cev1, what(E1, departureTravel(Cev1, P1x))))),\\ &\quad \mathit{mev}(Tx, bel(Spx, cE(Cev1, who(E1, P1x)))),\\ &\quad \mathit{mev}(Tx, bel(Spx, cE(Cev2, what(E2, arrivalTravel(Cev2, P2x))))),\\ &\quad \mathit{mev}(Tx, bel(Spx, cE(Cev2, who(E2, P2x)))).\end{aligned} \tag{8.4.2}$$

ATem1	The travel is done with which specific reasons
ATem2	There is a machine or an instrument that physically performs the journey
ATem3	In the diegesis it is presented the mechanism or the physical law that allows the time travel
ATem4	The travel is shown in the diegesis
ATem5	There is the intention of the character to travel through time
ATem6	The character can choose to go and get back from the past or from the future
ATem7	The access of the characters in the temporal context is without physical transportation
ATem8	Under the hypothesis ATem7 (there is no physical transportation of characters in the temporal context) there only is a vision of past or future events
ATem9	The character has awareness of entering a temporal course of events

Table 8: Types of access to courses of events in the time travels

COMPATIBILITY RULES FOR TEMPORAL COURSES OF EVENTS. Stories of time travels have relations of compatibility among the courses of events composing it. The compatibility rules for many stories of this category, regard the preserving of the properties of objects and of characters travelling in time (physical aspect, biologic age, and so on). Mental states (beliefs) of characters are often preserved – the events happened in previous courses of events, are remembered in the current course. Such knowledge are often used by some character to modify past events, with the aim of changing the course and the end (no desired) of a story.

In the following table 9 I report some of the most frequent relation of compatibility existent among courses of events characterizing stories of time travels:

CTem1	There is character's memory who travels through time about the events that are believed to happen in other courses of events
CTem2	Preservation of object properties travelling through time
CTem3	Preservation of character's physical properties travelling through time
CTem4	Simultaneous change of the objects properties in all courses of events
CTem5	The character increases his skills in each access to the course of events

Table 9: Compatibility rules among temporal courses of events

MODELS OF TIME TRAVELS The scheme reported in the diagram 8.4.1 represents a model of time travel in which there is a return back in time, on a temporal interval where the events in the story have been already shown. Almost always these kind of time travel figures exhibit counterfactualities in all the temporal interval of the past, in which the story returns in back. In fact such narratives are built in a manner so that the spectator can make a comparison with some situations already happened in a previous course of events. Generally, in the movies in which there are time travels, the filmic segment of the travel narration takes a small time interval of narration, sometimes the interval is void. In the model I present, I have made the assumption (to simplify the modelling) that time travel begins and ends in the course of events where the travel has been conceived.

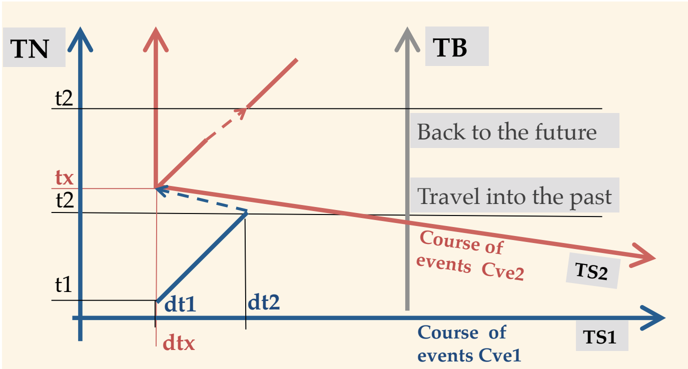

Figure 8.4.1: Time travel diagram with travel into past already shown in the narration

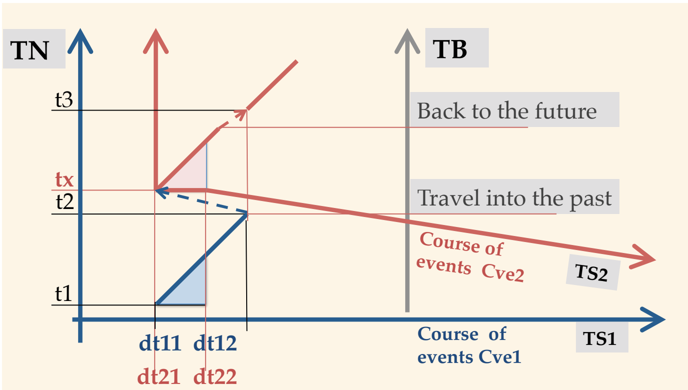

Figure 8.4.2: Models of time travels in *Harry Potter and the Prisoner of Azkaban*

In the diagram 8.4.2 another model of counterfactual story is presented. This model differs – with a little variation – from the one reported in 8.4.1, as only a part of events belonging to the past of the story generates counterfactualities (in figure 8.4.2 the intervals [dt11, dt12] and [dt21, dt22] represent parts of story where do not exist counterfactualities).

The diagram 8.4.2 represents the story of *Harry Potter and the Prisoner of Azkaban*, in which the instrument Time-Turner[24], allows some characters to come back in a course of events.

24 Time-Turner is used to make travel through time one or more people. For every hour that you desire travelling in the past time, the Time-Turner must be turned once.

In a first segment of the narration of *"...Prisoner of Azkaban"*, there is not counterfactuality. Harry and his friends, also if are not visualized in the first course of events, are responsible of the throwing of the stones that are used to warn their homologous in the other course of events, about the schoolmaster arrival, together with the executioner who would have to behead Buckbeak.

The throwing of the stones had to suggest Harry and his friends that they had to leave the house in which they were. The counterfactuality instead happens when in the second course of events $Cve2$ (see diagram in figure 8.4.2) Harry and his friends release Buckbeak and save his life (as it is known in the first course of events $Cve1$ Buckbeak is killed) and it manifests a counterfactuality.

Harry Potter and the Prisoner of Azkaban presents from the point of view of the access to the temporal context the following structural characteristics:

1. it is valid ATem1 – as the Harry and C's travel happens with an explicit motivation – rescuing Buckbeak;
2. it is valid ATem2 – as it exists an instrument that allows the time travel – the Time-Turner;
3. it is not valid ATem3 – as it is not described the mechanism or the physical law that allows the travel - Time-turner has the function to make persons travelling in time but there isn't any explanation about how it does;
4. it is not valid ATem4;
5. it is valid ATem5 – as there is the intention by Harry and C. to travel in time;
6. it is valid ATem6 – as Harry and C. have the possibility to decide to come back from the temporal context;
7. it is valid ATem7 – as Harry and C. don't use a machine that transport them physically with a travel;
8. it is not valid ATem8;
9. it is valid ATem9 – as Harry and C. have the consciousness to enter in a temporal course of events.

While from a compatibility point of view among the courses of events $Cve1$ and $Cve2$:

10. it is valid $\mathtt{CTem1}$ for the characters who travels in time – Harry and C. remember the events $Cve1$ of the first course of events. It is to observe

that the other characters who don't travel in time and that are present in both the temporal courses of events $Cve1$ and $Cve2$, as for example the school teachers, don't remember the happened events;
11. it is valid $CTem2$ – above all for the Time-turner that has to maintain its properties;
12. it is valid $CTem3$ for the characters who travel in time – Harry and C., while for the other characters travelling through time such as Buckbeak it is not valid – the latter dies in the first course of events $Cve1$ and and is alive in the second course of events $Cve2$;
13. it is valid $CTem4$ for the characters who travel in time – Harry and C. – for the school teachers it is not valid.

Another model of time travel is given in figure 8.4.4, in which there is a travel in a temporal context, and the past events are shown for the first time in the telling. The model given in figure 8.4.4 adopted to model time travels such as the one present in *Terminator*[25] in which a character comes from the future (without any explanation on how the time travel could have been possible) and the course of events has not yet shown in the telling.

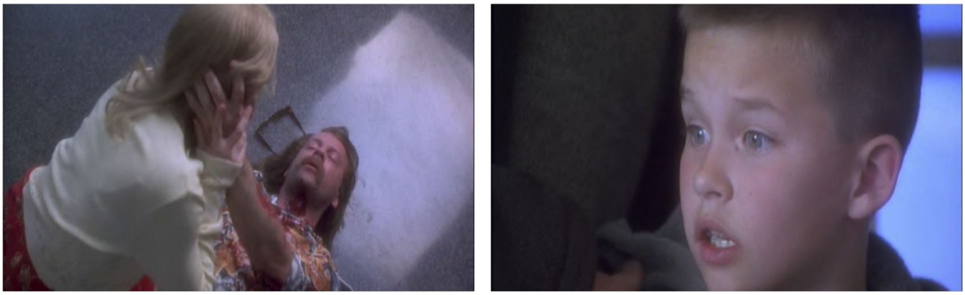

Figure 8.4.3: *Twelve Monkeys* – little James assists to the killing of the adult James

Time travel present in **Twelve Monkeys**[26] can be represented by the just described model, in which inside every course of event, is respected the integrity criterion. In *Twelve Monkeys* every course of event is activated through a time travel, explicitly enunciated in the story. Often the time travel is introduced in the story with temporal captions, through which the spectator can anchor the

25 *Terminator* [Terminator] is American science fiction action movie directed and written by Cameron, starring Arnold Schwarzenegger, Michael Biehn and Linda Hamilton.
26 [TwelveMonkeys]

events on the axis of story, by applying a simple inference – such as 4.5.1 introduced in the paragraph 4.5.1. The protagonist James Cole (Bruce Willis) in time travelling keeps his physical properties. Among the rules of compatibility, there is also the one regarding that the physical objects that travel in time preserve the properties (it is valid the rule CTem2) – an example regards the sensors that are inserted in the gums of some characters, having the function of localizing their moving, also if they travel in time. It is obvious that these sensors possess, as rule of compatibility, the preservation of their properties in all the courses of temporal events.

Among the objects preserving the properties in this story, I highlight the bullet in Cole's leg that remains unaltered in all his time travels. In *Twelve Monkeys*, it is respected the compatibility rule `CTem1` among courses of events, that preserves the knowledge acquired by various characters in the courses of events. In the story there is also a particular variation of the compatibility rule `CTem1`, that regards Cole's knowledge on particular events happened in the childhood and that appear to him as vague remembrance, as visions or dreams. In particular, Cole has a painful recurrent remembrance that regards the killing of a man. The reason of this pain is revealed in the end of the telling: in a time travel "Cole child" meets "Cole adult", and "Cole child" is witness in an airport to the killing of "Cole adult" (the killing of himself – see the two still image in figure 8.4.3)[27]. The protagonist who meets himself is a narration figure that is present also in the story of Doc in the movie *Back to the Future Part II*, in which a mistake in the working of the time machine brings back Doc ten minutes early than the programmed time. This case raises a question if the presence of the two characters, that the spectator believes are the same person, violate the criteria of integrity inside of a course of event. I believe that there is not any violation, as the violation or a possible incongruity, have to be present in the spectator's beliefs. It is obvious that in real life it is not acceptable that a person can *split himself* in two, in a fiction world this situation is instead possible, as spectator's beliefs count, that is all the events he can accept, or cannot happen, into a fictional story.

27 A character who meets himself in a determined course of events, could be considered as a structural element that has a specific characterization, we could consider this characteristic, as a particular category of story. A proposal of this kind is present in a diagram, created by Janice Kay, in the net available at the link http://sciencefiction.com/2013/04/29/time-travel-flow-chart-explains-use-of-time-travel-in-movies

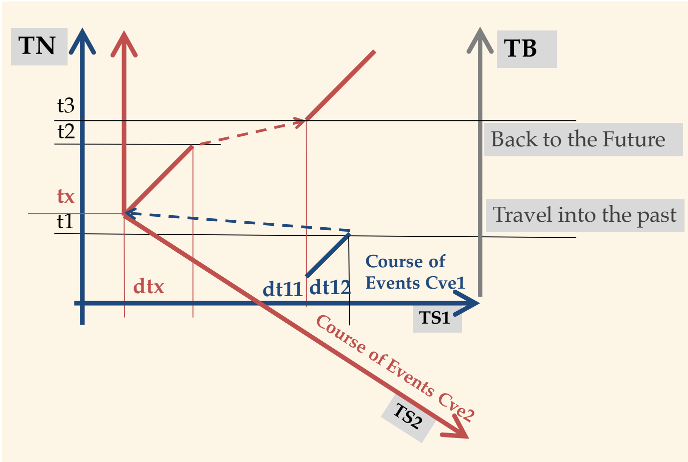

Figure 8.4.4: Time travel model with travel into past not shown in the narration

To simplify the analysis I call Doc_1 the character Doc that has not yet travelled in time and Doc_2 his homologous who has travelled in time. In *Back to the Future II* Doc_2 has made the travel through a causal chain of events, that the spectator has fully shared – the story and every travel step (from the initial program) – the story has always given all the scientific explanations about how the travel could have been possible. Doc_2 comes from the future and to the spectator has been explained how it could have been possible, and in addition there are the images of the movie showing Doc_1 and Doc_2 in a scenario that the viewer has before his eyes – then (at least in that world of fiction) you can.

Also the staging and the kind of discourse of the telling, contribute to persuade the spectator. Doc_2 just came back from the future, peeks at Doc_1 from behind a petrol station – Doc_2 indicates Doc_1 and speaks in first person[28] this persuade the spectator that the character in action is only one, the other Doc_1 is only indicated by someone (Doc_2) – the situation is similar to when a person in the real life observes a photo of himself, when he was a child. The particularity of the situation in this way is not very far from the experience acquired by the spectator in his real world.

28 This observation is due to U. Eco in his work ”The limits of interpretation” Bompiani, 1990, p. 209

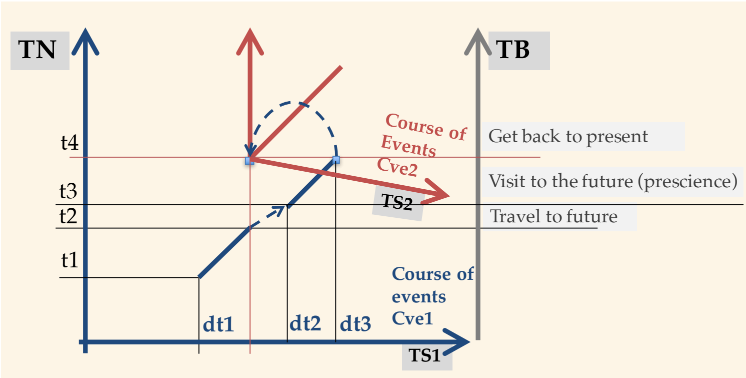

Figure 8.4.5: *Minority Report* – TN-TS-TB diagram

Definitely, in the sequence taken into account the spectator has almost always all the justifications to accept that Doc_2 meets Doc_1. Among the most important justifications, there is surely the one that the character Doc_2 has travelled in time, this latter is a really sensational fact that leads the spectator to record explication of the kind: "Doc_2 has travelled in time, that's why Doc_1 finds himself beyond the road".

Doc's story in *Back to the Future II* confirms an important property, that the stories with time travels contain temporal bifurcations and counterfactualities, but can also contain unusual superimpositions of events, such as the ones relating to the double presence of a character – these latest are believed possible by the spectator (obviously only in the ambit of a fiction story). A category of time travels with a specific characterization is the one in which **time travel happens without the physical transport of the protagonist**. What happens in this stories is that not being a moving of a character, there is an access just to say *in reading* of some events of the past or of the future – the events can be seen by characters, but they do not perform (cannot) any modification on the events, although some characters use the precious information existing in a current course of events.

In these stories, there is always a mechanism that allows the vision of the past or future events, but there is not any machine that transports people. In **Minority Report**[29] are present particular types of time travels happening

29 [MinorityReport] is movie directed by Steven Spielberg, interpreted by Tom Cruise, Colin Farrell and Samantha Morton, loosely based on the short story of the same name by Philip K. Dick.

without the existence of a true time travel of some character (type of access $\mathsf{ATem8}$). In the this story the pre-crimes is a police team using the *precogs* persons who can predict (more properly seeing) the future, in particular they are capable of seeing the killings in advance.

The pre-crimes act on signaling of the precogs avoiding the happening of crimes, by intervening in advance on the potential criminals. Precog's presage is only a mechanism of prediction – also if there has not been (physically) a time travel, we know what will happen in the future. Thereby, precogs' capacity of the prediction of events is equivalent to make a time travels in the future, with an (almost immediate) come back to the present (see figure 8.4.5).

8.5 LEVELS OF REALITY

As it happens for the stories regarding time travel and the stories containing counterfactualities, for the levels of reality exist various access modalities, depending by the particular story. A list of the most frequent access modalities is given in the table 10. As typical scheme of access to a level of reality we have to consider the example of *exiXtenZe* outlined in the diagram in figure 8.5.2. In *exiXtenZe* the access levels are determined $\mathsf{ALiv1}$ by an apparatus that is applied to the vertebral column. It is not valid $\mathsf{ALiv2}$, as in the access there isn't any physical explanation of the reason why the characters are introduced in the levels. At regarding the access type for *exiXtenZe*, the condition $\mathsf{ALiv3}$ is valid, as there is the characters' intention to enter in the reality level of the game. The entrance at the level and the exit from it, is of the kind $\mathsf{ALiv4}$, as the characters are free to go out and enter into levels.

It is valid a condition of access of the kind $\mathsf{ALiv5}$ as there isn't a physical transport in the game levels.

The accesses to the levels are characterized also by the component $\mathsf{ALiv6}$ as the characters have the awareness to enter in the various levels, also if not always they can distinguish if they are in the reality or in game reality level.

MinorityReport is a movie on the free will using time travel as narrative structure to give birth in the spectator some questions of a philosophical on the subject.

ALiv1	There is a machine or an instrument that physically permit the access to the level of reality
ALiv2	In the diegesis is presented the mechanism or the physical law that allows the access to the level of reality
ALiv3	There is the intention of the character of accessing to the level of reality
ALiv4	There is control of the character of entering and exiting from the level of reality
ALiv5	The access in the level of reality happen without physical transportation
ALiv6	The character has awareness of entering a level of reality
ALiv7	The access takes place in an existing level of reality
ALiv8	The access takes place in a level of reality that did not exist and that is created from the outgoing level of reality

Table 10: Types of access to the levels of reality

In the end in *exiXtenZe* is valid the condition of compatibility $ALiv7$ as the ambient of the game is still existent when the characters enter in the game levels. Obviously is not valid $ALiv8$, as from the inside of the reality levels are not generated other levels.

Also the stories presenting levels of reality have specific relations of compatibility among the different levels, and also these one vary from story to story (see table 11).

I report the diagram 8.5.1 with the aim to present some compatibility relations. The scheme reports two reality levels $L1$ and $L2$, in which at the time of narration tx (common to both levels), there is an access to the level $L2$ of reality. The scheme doesn't specify the kind of access, if the level of reality already existed, or if it has been created in the moment of the access – I report such diagram with the only aim to give examples of compatibility relations

($\mathsf{CLiv1}$, $\mathsf{CLiv2}$ and $\mathsf{CLiv3}$). The three relations are formally represented as follows:

$$\begin{aligned} & mev(Tx, bel(Spx, sameDur(D1, D2))) \;\leftarrow \\ & \; mev(Tx, bel(Spx, cE(Cev1, dur([Td13, Td14], D1)))), \\ & \; mev(Tx, bel(Spx, cE(Cev2, dur([Td21, Td22], D2)))), \\ & \; mev(Tx, bel(Spx, homologousT([Td13, Td14], [Td21, Td22]))). \end{aligned} \tag{8.5.1}$$

The representation uses the spectator's belief on homologous interval, as in some stories he perceives the existence of events that develop in simultaneity with events of other levels of reality. In generale we can say that two intervals are homologous when belong to two different course of events and exists at least one rule of compatibility between of them, that is the spectator believes

CLiv1	The levels of reality are both active
CLiv2	Same temporal duration among the levels (under the condition CLiv1)
CLiv3	The correspondent events in the levels happen in the same diegetic interval
CLiv4	The corresponding events happen in the levels temporally staggered
CLiv5	The destruction of a level of reality Lx, that generates other levels of reality Liv_i, causes the destruction of all levels Liv_i
CLiv6	Transitive relation for destruction the levels of reality

Table 11: Compatibility relations of the levels of reality

that the two levels of reality are both active after the narration time tx and the time passing in $L1$ has the same duration in $L2$.

The scheme in the table 10 and the compatibility relations 11 can used as a model for all those stories in which a person is sleeping, and while he sleeps, his homologous is present in other level of reality – or also when a character is sleeping and his homologous physically enters to another reality level, as it happens in the story of *Avatar* and *Inception*.

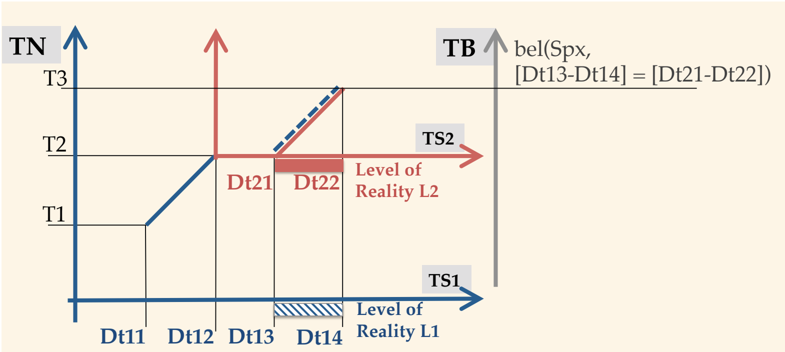

Figure 8.5.1: Compatibility relations among events having same temporal duration in different reality levels

In the movies in which there is an access of the kind $Aliv7$, and the level of reality has been created inside of level (for example in the movie *Nirvana* and *Inception*), if it is destroyed a level La that has generated another level Lb, then also the level Lb is destroyed. This relation in some stories can be valid also for only a character who ceasing living in a determined level of reality causes the death of his homologous character in another level of reality.

For example in the story of *Avatar*, the protagonist Jake Sully is in a sleeping state (Px) inside of a special technological capsule (that is a determined level of reality (Lx)) from which he controls his homologous body – an avatar (Py) – through a mental interface. Jake Sully in this way, in his homologous Na'vi, lives in Pandora (reality level ($L1$)), with his soul sensitivity and cognitive skills. For a long section of the narration, the spectator believes that the end of the life of Px causes the death of Py[30].

$$\begin{array}{l}
mev(Tx, bel(Spx, what(E4, dead(Py)))) \leftarrow \\
\quad mev(Tx, bel(Spx, cE(Cve1, E1))), \\
\quad mev(Tx, bel(Spx, cE(Cve1, who(E1, Px)))), \\
\quad mev(Tx, bel(Spx, cE(Cve1, what(E1, enteringLevelR(Px, Cve2))))), \\
\quad mev(Tx, bel(Spx, cE(Cve2, E2))), \\
\quad mev(Tx, bel(Spx, cE(Cve2, who(E2, Py)))), \\
\quad mev(Tx, bel(Spx, cE(Cve2, homologue(Px, Py)))), \\
\quad mev(Tx, bel(Spx, cE(Cve1, E3))), \\
\quad mev(Tx, bel(Spx, cE(Cve1, what(E3, dead(Px))))), \\
\quad mev(Tx, bel(Spx, cE(Cve1, who(E3, Px)))), \\
\quad mev(Tx, bel(Spx, cE(Cve2, E4))), \\
\quad mev(Tx, bel(Spx, cE(Cve2, who(E4, Py)))).
\end{array} \tag{8.5.2}$$

In some stories with *deeper* levels of reality, if there is a destruction of a reality level Lx that has generated other levels L_i, then there also is the destruction of all levels L_i generated by Lx.

An example of this compatibility rule is present in Nirvana[31], in which in a determined level of reality a man destroys the program that has generated the level in which he himself lives. This rule of compatibility has been called by us *transitive relation of destruction of the levels*.

Often in the recent movie stories, the access to the level doesn't happen through a physical link, but through a mechanism of mental transmission, as it happens in *Avatar*[32] or in *Inception*[33] – in which the character and his homologous, exchange information each other, without corporal movements, physically staying in the respective levels of reality.

30 As it is known the compatibility relation existing among the courses of events in the *Avatar* movie will change in the end of the telling – we return later in this paragraph on how the story justifies this change.

31 [Nirvana]

32 *Avatar* [Avatar] is a movie written and directed by James Cameron - interpreted by Sam Worthington, Stephen Lang, Zoë Saldaña, Sigourney Weaver, Giovanni Ribisi e Michelle Rodriguez. Avatar is until now, the movie that has earned the most in movie's story. In 2011 it has won three oscar prizes.

33 Inception [Inception] is a movie produced and directed by Christopher Nolan – interpreted by Leonardo Di Caprio, Tom Hardy, Ken Watanabe, Joseph Gordon-Levitt, Ellen Page, Marion Cotillard and Cillian Murphy. In 2011 it has won four Oscar prizes.

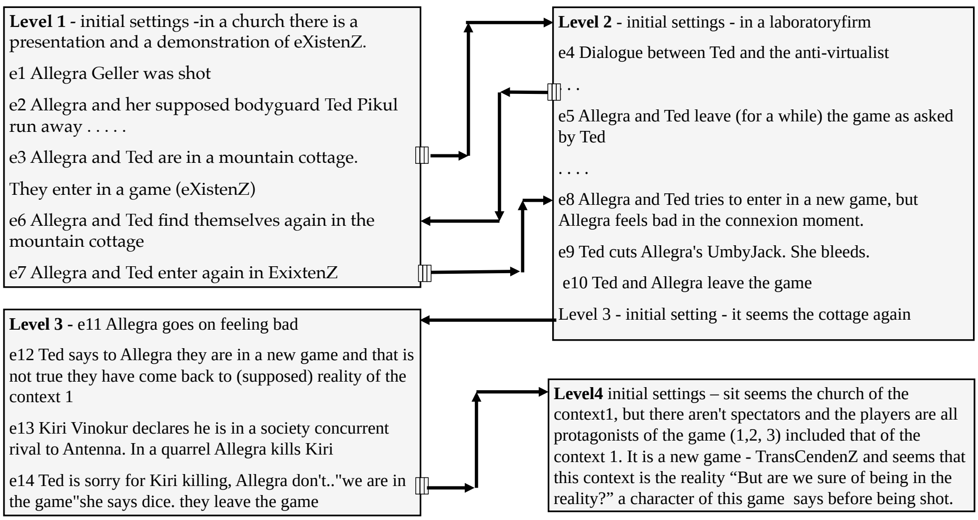

Figure 8.5.2: Final levels of reality construction for *exiXtenZe*

The passages among the courses of events present in the movie *The Lake House*[34], in some classification in the cinematographic ambit have been considered as time travels, according to us they must be labelled as passages among reality levels. It is in fact a story that possesses two reality levels, in which the mailbox has the role to link physically the two levels of the spatial contexts in which the characters live. The diagram 8.5.3 relating to the telling of *The Lake House*, represents the following main structural characteristics of movie:

1. there are events belonging to two different reality levels L1 and L2;
2. the events of the two levels L1 and L2 alternate themselves on the axis of narration;
3. the events of the two levels have the same temporal duration;
4. all the events of the reality level L1 are two years far from the homologous ones of the level L2.

Kate and Alex live two stories that are temporally two years distanced. In the story occurs a counterfactuality when it is shown the event in which Alex

34 *The Lake House* [LakeHouse] is a film directed by Alejandro Agresti and starring Keanu Reeves, Sandra Bullock and Christopher Plummer. The main character is an architect living in 2004 and a doctor living in 2006. The two meet via letters left in a mailbox at the lake house they have both lived in at separate points in time.

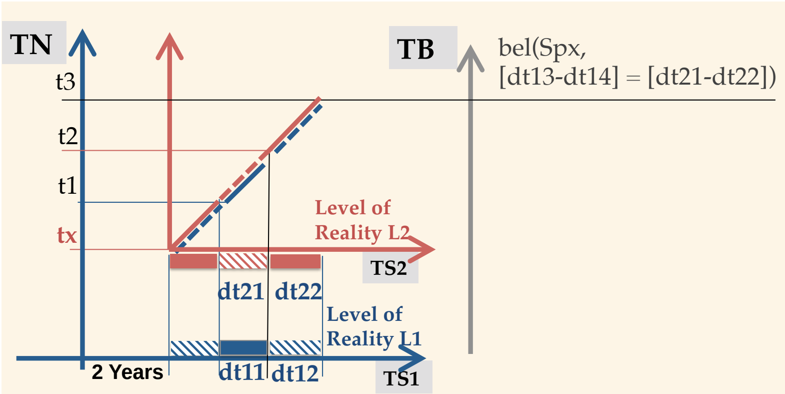

Figure 8.5.3: Relations among reality levels in The Lake House

doesn't cross the road in Daley Plaza and remains still on the footpath (so, he doesn't die) as previously in the telling, it is shown Alex who is invested by a vehicle in the same square.

There are narratives presenting levels of reality that put staged characters' mental states in which the story develops. In paragraph 6.4, I have already discussed some examples of stories where the dreams of a character are staged. To the same category belong all those narratives where are staged character's mental events, triggered by character's pathologies.

In this regard from a classificatory point of view, there are two major categories of narratives:

1. narratives in which reality and character's mental state are two separate levels, in which between the mental level and the real one, there are no fluxes of knowledge, ie where the rules of compatibility between the levels do not establish restrictions (constraints) in the transition of knowledge from a level to another;
2. narratives in which between reality and mental level exists a channel of knowledge exchange, in which reality, dream, and character's mental state tend to merge into a only level

Although the category 1 excludes the existence of compatibility rules between the levels, often the contents of a character's dream, like a nightmare or a desire, indirectly influence the real life of the character. In the category where dreams and reality are separate belong movie stories that present large tracts (often initial of the narration) where the viewer is unable, from the events up to that point presented in the story, to recognize that you are representing dreams or mental states of a character. I refer to stories like *Mulholland Drive*[35] and *Identity*[36], where to the viewer is revealed (at a certain instant of the narration) that the events of the story belong to a mental level. These stories require to the spectator a high cognitive effort to re-classify (almost always at the end of the film) of those dreamlike events registered as real events. In any case at the end of the narration, the spectator is able to establish which events belong to the mental story of the character, and which are not.

To the 2 category belong stories where character's mental level and reality are not distinguished, neither at the end of the narration. This occurs, not for the inability of the viewer but for an intrinsic characteristic of the story - as in *In the Mouth of Madness*[37] and *The Sixth Sense*[38].

The Sixth Sense is the story of the child psychologist Dr. Malcolm Crowe, who on that day in which receives a high recognition for his work as a psychologist of children with mental problems, gets shot by Vincent Grey – a former patient and child, who accuses the doctor of not having treated him well.

The story jumps to eight months after this happening. Malcolm meets another patient of 9 years old – Cole Sear – with problems similar to the ones of Vincent. It is clear that Cole's illness is a second chance for Malcolm, thinking about years before at his failure in the treating the other child. Malcolm discovers that Cole has visions of dead people and suggests him that these people have not intentions to hurt him. Malcolm asks Cole to help him about some problem that people had in their life before dying. Malcolm as a doctor has fulfilled to his task. Cole does not feel no longer pain for his own mental disorder as he is gratified in helping people. However, before the telling ends, the story reveals that Malcolm is nothing more than a character who only lives in Cole's mental state – just like the other visions that Cole had. Malcolm is himself a dead man who has asked for help to Cole, and in treating Cole he has helped himself.

35 *Mulholland Drive* [MulhollandDrive].
36 *Identity* [Identity].
37 *In the Mouth of Madness* [MouthOfMadness].
38 *The Sixth Sense* [SixthSense].

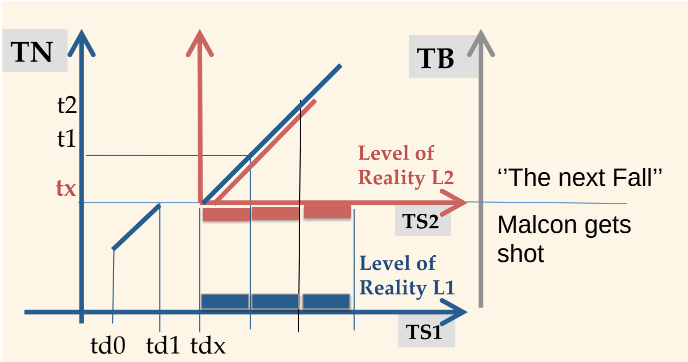

Figure 8.5.4: Relations among reality levels in *The Sixth Sense* at end of the narration

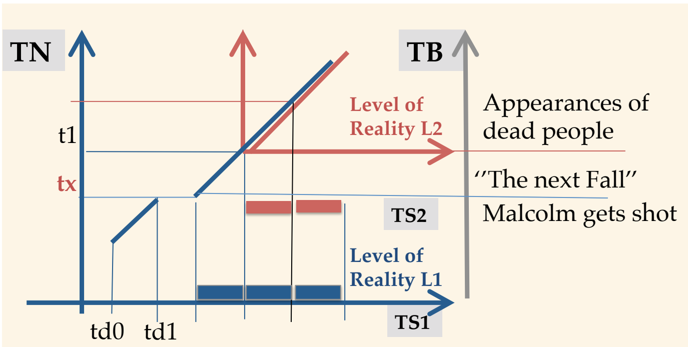

Figure 8.5.5: Relations among reality levels in *The Sixth Sense* before the narration shows that Malcolm is dead

From a structural point of view the story, from the instant that Malcolm is fired, stages the mental state of Cole - and in this level of reality doctor Malcolm tells Cole's story.

We must consider that only when the narration reports Malcolm is dead the viewer believes that Malcolm belongs to the course of Cole's mental events (L2). Until that point in the narration the viewer believes that the dead who Cole saw, belong to a course of mental events (see diagram in figure 8.5.5)[39].

39 In [Barratt2009] and [Stewart2014] other analyses of the film *The Sixth Sense* have been reported. In my argumentation I highlight (in a strictly cognitive approach) the viewer's beliefs in relation to the belonging of the characters at the different levels of reality present in the story.

In movie *In the Mouth of Madness* the indistinguishability between the mental (or fictional level), and the real one, is also the main theme of the story. The final thesis is that both levels can be distinguished by the persons only by their mental processes. A statement present in the recitation story this way: is real only what we believe is real.

In the story of *In the Mouth of Madness*, the writer Sutter Cane writes so well his stories, to the point of creating in the minds of people the conviction that the monsters of his tales, also exist in the reality. This for some characters is a disease, for others it is not. The protagonist John Trent comes to believe that reality and fiction, the real and story characters, are not distinguishable.

At the end of the telling in a cinema Trent assists at the screening of his own life, a story titled *In the Mouth of Madness* (just as the title of the entire movie). Trent laughs looking the events on the screen, this latter are the same present in Cane's book, from which the film have been scripted. John Trent is a real person, and at the same time is a character in the story written by Cane.

In both types of narrative 1 and 2 the viewer must apply particular causal rules, because all the events presented in the story are suffered by the characters, and no caused by they, so as is the case in a context of real events.

Stories possessing reality levels don't introduce new models regarding the temporal reasoning – the argument to which I have dedicated the principal attention on this book – but if in a story there are accesses to levels of reality, these contribute to increase the grade of fragmentation of the same story.

8.6 FOR A GENERALIZED MEASURE OF FRAGMENTATION OF A STORY

Basic units (see table 12) of the puzzle, counterfactual and open stories, or also stories where there are time travels or reality levels, are a significant set of stories, that can be fully labelled as **stories with a complex plot**. These stories are characterized by the different basic units of narration, and as I have already written in this book, by the existence of particular inferential rules involving temporal and causal cognitive activities of the spectator.

The metric I have given in paragraph 7.4 regarding the fragmentation of a puzzle story, can be extended by considering besides the traditional breaks

STORIES TYPE	BASIC NARRATIVE STRUCTURE	INTERRUPTION TYPE	INFERENCE CHARACTERISTIC
Puzzle Stories	Macro event	Break	Recognition of a temporal jump
Open Stories	Macro event	Temporal Contraddiction	Recognition of contraddiction
Counterfactual stories	Course of events	Or-exclusity beetwen events	Recognition of a Counterfactuality
Time travel stories	Course of events	Temporal travel	Recognition of a time travel
Level of reality	Course of events	Access to level of reality	Recognition of a access to a level of reality

Table 12: Types of stories and basic narrative structures

(ellipsis, flashbacks, and so on) also the quantity of counterfactual temporal points, the number of nesting of the levels present in a story, the number of time travels and every factors that could interrupt a course of events of a story. A generalized measure of fragmentation has to keep into account that the stories can present different basic unit of the narration.

Part VI

Conclusion

9 NOTES FOR A CONCLUSION

In this book I proposed a theory to understand film stories, mainly concerning the temporal reasoning aspects of a spectator while of watching a movie. The work has been developed by adopting a cognitive approach through the examination of the acquisition mechanisms and review of the same viewer's beliefs, about the events of a film story. The models were defined by rewriting the G. Genette's theory in cognitive terms on the relationship among the time of the narration and time of the story, adding a new analysis axis in which viewer's beliefs are represented. Always in cognitive terms, some main models for the flashback (flashforward) have been defined, in particular Reichenbach's theory (proposed for texts of literature) has been rewrited, redefining for film stories, the notions of event time, enunciation time and reference time.

Through this representation I have proposed various models of reasoning having the objective of formulating a computational model for the construction of the fabula. I have also provided a measure of the degree of story fragmentation, which can be considered as the cognitive cost of a generic viewer, for the understanding of the story itself.

The puzzle films, the counterfactual stories, those related to time travels and levels of reality constituted the analytical material that inspired the proposed models. The intent in this book is also to provide an answer to most of the discussions and reflections that have been born around to films with complex plots, whose puzzle films are a representative large subset.

Although my attention has been given to the temporal aspects, I believe that the proposed methods (mostly coming from the scope IA) may constitute a methodology for the construction of more complex cognitive models of cinematographic relevance, regarding the identification, the expectations, the emotions etc.

While the time of book writing, I realized that I'm not good to write a book (at least to write a book of this size). It takes much discipline to do this - staying on the main objectives proposed, being proficient to give up or even eliminate also interesting parts of theory if can lead far from the fixed objectives, and above all, do not be in love with all my notes.

Not having these qualities in the end I cut with regret and so bad. Actually I have the illusion to leave something that could included in another book – that with a good probability won't be written.

Each discussed typology of story categories would require a separate essay. I decided to present a theory that contained narrative figures and cognitive models of basic, that could be adopted for the analysis to a wide class of films with a complex plot.

I do not wish to hide the fact that this book was written with some ambitious expectations, despite being aware that it certainly contains errors and that many topics covered are only the beginning of other topics which necessarily requires additional insights.

I expect that this book can also generates some (and perhaps many criticisms), and someone would propose extensive revisions. My hope is this work can be an initial discussion for a cognitive computational theory to understand of film stories.

According to the formal aspects, I foresee aspects of the proposed representation, which surely have points that need to be expanded or even redefined.

In an attempt to fend off by now some shots, I wish to report, that was not my intention to write a book where the formalism occupies the main place - rather of proposing a theory and a new method of film analysis.

In the end I was left with a big question, whether it is really useful to make a cognitive computational theory, for the understanding of the stories of films. Perhaps as a final artifact, a computational model may seem unnecessary, but as a tool and a methodology of investigation, I believe it is useful - indeed, I am really convinced.

Part VII

Appendicies

10 *PULP FICTION* AND SPECTATOR'S INFERENTIAL ACTIVITY

In this section I report an annotation of the movie *Pulp Fiction*, with the corresponding attributions of beliefs to the spectator about the components of story events:

$$\begin{array}{l} annotation(An, Seg_i, Tf_i, bel(Spx, when(E_i, [Tdi_i, Tdf_i]))) \\ annotation(An, Seg_i, Tf_i, bel(Spx, what(E_i, Action_i))) \\ annotation(An, Seg_i, Tf_i, bel(Spx, where(E_i, Place_i))) \\ annotation(An, Seg_i, Tf_i, bel(Spx, who(E_i, [Participant_{i,j}]))) \end{array} \qquad (10.0.1)$$

where An is the author's annotation, Tf_i is the end time of the filmic segment presentation Seg_i, and $when(E_i, [Tdi_i, Tdf_i])), bel(Spx, what(E_i, Action_i))$, . . . are the viewer's beliefs.

From the annotations 10.0.1 I analyze the spectator's inferential activity to anchor the story events. I report the activated rules for each inference performed. *Pulp Fiction* narrative structure, there are different kind of anchoring. The initial hypothetical ellipsis and the wideness of relative deixis (whose length is almost similar to the one of the movie) characterizes this telling. The complexity of the story plot and the reconstruction of the fabula, require to the spectator a high cognitive effort. Also if complex the *Pulp Fiction* fabula is closed, that is, at the end of the narration, the spectator, starting by the filmic events enunciated in the filmic text, and for the inferential cognitive patrimony he has, is able to reconstruct the whole story axis. My analysis of *Pulp Fiction* has been divided in 24 sequences, in which everyone is represented as a set of macro events, containing the story events. For the annotation of events, I have taken into account only those that are temporally or causally relevant to the analysis of the story.

S1 - COFFEE SHOP ($e1x$). A young man$_{p1}$ and a young woman$_{p2}$, both with an English accent, are sitting$_{e11}$ inside a bar$_{w11}$ and they are talking$_{e12}$. The young man$_{p1}$ says$_{e13}$ "garcon, coffee"$_{f1}$ (referring to the waitress) then they get ready to implement a robbery in that bar. The young man$_{p1}$ holds$_{e14}$ a gun$_{c11}$. The man$_{p1}$ says$_{e15}$ "Nobody move, this is a robbery"$_{f2}$. The woman$_{p2}$ says$_{e16}$ "and if by chance any of you assholes dares to move, I'll kill you, ugly motherfuckers, every last"$_{f3}$. Corresponding to these events, the following beliefs are generated in the spectator:

```
mev(t12, bel(spx, when(e11, on([td11, td12])))).
mev(t12, bel(spx, what(e11, sit(p1, p2)))).
mev(t12, bel(spx, where(e11, w11))).
mev(t12, bel(spx, who(e11, p1))).
mev(t12, bel(spx, who(e11, p2))).

mev(t18, bel(spx, when(e14, on([td17, td18])))).
mev(t18, bel(spx, what(e14, hold(p1, c11)))).
mev(t18, bel(spx, where(e14, w11))).
mev(t18, bel(spx, who(e14, p1))).
mev(t18, bel(spx, who(e14, p2))).

mev(t14, bel(spx, when(e12, on([td13, td14])))).
mev(t14, bel(spx, what(e12, talk(p1, p2)))).
mev(t14, bel(spx, where(e12, w11))).
mev(t14, bel(spx, who(e12, p1))).
mev(t14, bel(spx, who(e12, p2))).

mev(t110, bel(spx, when(e15, on([td19, td110])))).
mev(t110, bel(spx, what(e15, say(p1, f2)))).
mev(t110, bel(spx, where(e15, w11))).
mev(t110, bel(spx, who(e15, p1))).
mev(t110, bel(spx, who(e15, p2))).

mev(t16, bel(spx, when(e13, on([td15, td16])))).
mev(t16, bel(spx, what(e13, say(p1, f1)))).
mev(t16, bel(spx, where(e13, w11))).
mev(t16, bel(spx, who(e13, p1))).
mev(t16, bel(spx, who(e13, p2))).
mev(t112, bel(spx, when(e16, on([td111, td112])))).
mev(t112, bel(spx, what(e16, say(p2, f3)))).
mev(t112, bel(spx, where(e16, w11))).
mev(t112, bel(spx, who(e16, p1))).
mev(t112, bel(spx, who(e16, p2))).
```

I suppose that for those first beliefs, the spectator doesn't perform any temporal anchoring. The sliding of the headings – so as it appears in the movie, after the first episode – can create particular hypothesis in the spectator. First of all, to let believe that the sequence S1 can be a kind of prologue, an antecedent to have as referral during the development of the story.

A posteriori as we know, this hypothesis will reveal as false – S1 is an central part of the story and plays an anchoring role, with a final surprise in the narrative structure. In the great part of the movie the events of this sequence will remain not anchored (see Figure 45). Only at the end of the narration

Figure 10.0.1: *Pulp Fiction* – Coffee shop macro event not anchored at the beginning of the narration

the spectator possesses the knowledge that are necessary to temporally locate the events for this macro event, as I will see, in it there are some events that repeat themselves and that will allow the spectator to anchor the two opening and final macro events of the story.

I have been tempted to consider the headlines as integral part of the filmic text, a kind of independent episode of the story, also if not possessing events, as they push the spectator (in an erroneous way) to consider the events contained in S1 as a kind of prologue of the story. Then, I have abandoned this analysis, by considering already complex the structure of this movie, by *weighing it down* with other interpretative hypothesis.

S2 - VINCENT AND JULES (*e*2x**).** Vincent$_{\mathrm{p}3}$ and Jules$_{\mathrm{p}4}$ talk$_{e21}$ in the car$_{w21}$. Vincent$_{\mathrm{p}3}$ tells$_{e22}$ Jules$_{\mathrm{p}4}$ about his travel$_{e23}$ to the Netherlands$_{w22}$ and about the European food and the ways of saying and doing about eating habits of those populations. Vincent$_{p3}$ tells$_{e24}$ Jules$_{p4}$ that he will dine$_{e25}$ with Mia$_{p5}$.

$mev(t22, bel(spx, when(e21, on([td21, td22])))).$
$mev(t22, bel(spx, what(e21, talk(p3, p4)))).$
$mev(t22, bel(spx, where(e21, w21))).$
$mev(t22, bel(spx, who(e21, p3))).$
$mev(t22, bel(spx, who(e21, p4))).$

$mev(t24, bel(spx, when(e22, on([td23, td24])))).$
$mev(t24, bel(spx, what(e22, tell(p3, when(e23, after([td23, td24])))))).$
$mev(t24, bel(spx, where(e22, w21))).$
$mev(t24, bel(spx, who(e22, p3))).$
$mev(t24, bel(spx, what(e22, tell(p3, what(e23, travel(p3)))))).$
$mev(t24, bel(spx, what(e22, tell(p3, where(e23, w22))))).$
$mev(t24, bel(spx, what(e22, tell(p3, who(e23, p3))))).$

$mev(t26, bel(spx, when(e24, on([td25, td26])))).$
$mev(t26, bel(spx, what(e24, tell(p3, when(e25, after([td25, td26])))))).$
$mev(t26, bel(spx, what(e24, tell(p3, what(e25, dine(p3, p5)))))).$
$mev(t26, bel(spx, what(e24, tell(p3, who(e25, p3))))).$
$mev(t26, bel(spx, what(e24, tell(p3, who(e25, p5))))).$
$mev(t26, bel(spx, where(e24, w21))).$
$mev(t26, bel(spx, who(e24, p3))).$

The events $e23$, $e25$ have been referred happened by the character p3 Vincent (are arguments of an act of telling) and so are not events shown in the story. As reported in paragraph 5.5.2, when a character says that a determined event will happen, the spectator believes that this event will happen in the future. The rules 5.5.1, 5.5.3, 5.5.3 5.5.4, and 5.5.5 instantiated with $E1{=}e24$, $E2{=}e25$ lead to the following conclusions:

$mev(t24, addBel(bel(spx, when(e23, after([td23, td24]))))).$
$mev(t24, addBel(bel(spx, what(e23, travel(p3))))).$
$mev(t24, addBel(bel(spx, who(e23, p3)))).$
$mev(t24, addBel(bel(spx, where(e23, w22))))$

$mev(t26, addBel(bel(spx, when(e25, after([td25, td26]))))).$
$mev(t26, addBel(bel(spx, what(e25, dine(p3, p5))))).$
$mev(t26, addBel(bel(spx, who(e25, p5)))).$
$mev(t26, addBel(bel(spx, who(e25, p3)))).$
$mev(t26, addBel(bel(spx, where(e25, disco)))).$

As we will see going on, the beliefs $bel(Spx, when(e25, after([td25, td26])))$ and $bel(Spx, what(e25, dine(p3, p4)))$ will be decisive to anchoring the events of S2 with the ones of S6.

S3 - THE BRIEFCASE ($e3x$**).** Vincent$_{p3}$ gets$_{e31}$ the briefcase$_{c31}$ with the money. Jules$_{p4}$ interrogates$_{e32}$ Brett$_{p6}$. Jules$_{p4}$ plays$_{e23}$ the verse from Ezekiel 25:17$_{c32}$. Jules$_{p4}$ and Vincent$_{p3}$ shoot$_{e34}$ Brett$_{p6}$.

```
mev(t32, bel(spx, when(e31, on([td31, td32])))).
mev(t32, bel(spx, what(e31, get(p3, c31)))).
mev(t32, bel(spx, who(e31, p3))).

mev(t34, bel(spx, when(e32, on([td33, td34])))).
mev(t34, bel(spx, what(e32, interrogate(p4, p6)))).
mev(t34, bel(spx, who(e32, p4))).
mev(t34, bel(spx, who(e32, p6))).

mev(t36, bel(spx, when(e33, on([td35, td36])))).
mev(t36, bel(spx, what(e33, recite(p4, c32)))).
mev(t36, bel(spx, who(e33, p4))).

mev(t38, bel(spx, who(e34, p4))).
mev(t38, bel(spx, who(e34, p6))).
mev(t38, bel(spx, when(e34, on([td37, td38])))).
mev(t38, bel(spx, what(e34, shoot(p3, p4, p6)))).
mev(t38, bel(spx, who(e34, p3))).
```

S4 - THE AGREEMENT ($e4x$**).** S4 is a filmic sequence of Pulp Fiction, with many cognitive hooks created in the spectator. I begin to analyze the first events. Wallace$_{p7}$ meets$_{e41}$ Butch$_{p8}$. Wallace$_{p7}$ tells$_{e42}$ Butch$_{p8}$ about a future boxing match$_{e43}$ that will be fight by the same Butch$_{p8}$. Butch$_{p8}$ takes the commitment$_{e44}$ with Wallace$_{p7}$ to lose$_{e45}$ the boxing match$_{c41}$.

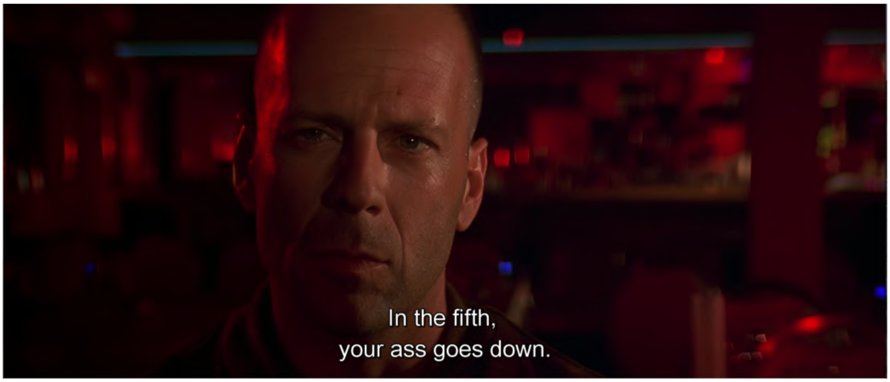

Figure 10.0.2: The agreement - Butch talks Wallace

```
mev(t42, bel(spx, when(e41, on([td41, td42])))).
mev(t42, bel(spx, what(e41, meet(p8, p7)))).
mev(t42, bel(spx, who(e41, p7))).
mev(t42, bel(spx, who(e41, p8))).

mev(t44, bel(spx, when(e42, on([td43, td44])))).
mev(t44, bel(spx, who(e42, p7))).
mev(t44, bel(spx, who(e42, p8))).
mev(t44, bel(spx, what(e42, tell(p7, when(e43, after([td43, td44])))))).
mev(t44, bel(spx, what(e42, tell(p7, what(e43, matchBoxe(p7)))))).
mev(t44, bel(spx, what(e42, tell(p7, who(e43, p8))))).

mev(t46, bel(spx, when(e44, on([td45, td46])))).
mev(t46, bel(spx, what(e44, tell(p7, when(e45, after([td45, td46])))))).
mev(t46, bel(spx, what(e44, tell(p7, what(e45, lose(p7, c41)))))).
mev(t46, bel(spx, what(e44, tell(p7, who(e45, p7))))).
mev(t46, bel(spx, who(e44, p7))).
mev(t46, bel(spx, who(e44, p8))).

mev(t46, bel(spx, what(e44, tell(p7, prop(agent, p7, lose(p7, c41)))))).
```

In spectator's beliefs it is necessary to consider also the properties of the character Butch:

```
mev(t42, bel(spx, propEv(e41, prop(name, p8, butch)))).
mev(t42, bel(spx, propEv(e41, prop(age, p8, adult)))).
```

$e43$ and $e45$ (aren't among the spectator's beliefs – that is $\mathrm{bel}(\mathrm{spx}, e43)$ and $\mathrm{bel}(\mathrm{spx}, e45)$ are not valid), have only been quoted by some characters in a conversation – such events are expected by the spectator happen in the story in future. The first $e43$ is an event of a character's telling, in which it is said that something will happen, while $e45$ is an event regarding the character's commitment to execute a determined action. Regarding the act of telling, supposing $\mathrm{E1}$=e42 and $\mathrm{E2}$=e43 in the inferences 5.5.9 and 5.5.3 (par. 5.5.2) you have:

```
mev(t46, addBel(bel(spx, when(e45, after([td45, td46]))))).
mev(t46, addBel(bel(spx, what(e45, lose(p7, c41))))).
mev(t46, addBel(bel(spx, who(e45, p7)))).
mev(t46, addBel(bel(spx, cmt(p7, e45)))).
```

The event $e45$ is an argument about a commitment taken. By instantiating the deiptic rule 5.5.11, 5.5.12, and 5.5.13 (par. 5.5.3) with $\mathrm{E1}$=e44 and $\mathrm{E2}$=e45, you have:

```
mev(t44, addBel(bel(spx, when(e43, after([td43, td44]))))).
mev(t44, addBel(bel(spx, what(e43, matchBoxe(p7))))).
mev(t44, addBel(bel(spx, who(e43, p8)))).
```

The implication of the previous inference is a spectator's expectation as believes that Butch will lose the match.

It is to consider that the spectator could doubt that the character $p8$ keeps his commitment – this generally depends on the capacity of the character himself and by the credibility that he has gained in the spectator – until here, by the events shown in the narration, the spectator cannot believe that Butch doesn't keep his commitment. In S4 it is presented a macro event in which: Jules$_{p4}$ bring$_{e46}$ briefcase$_{c42}$; Vincent$_{p3}$ wears$_{e47}$ a white t-shirt$_{c43}$ and light blue shorts$_{c44}$; Jules$_{p4}$ wears$_{e48}$ a light blue t-shirt$_{c45}$ and red shorts$_{c46}$.

$$
\begin{array}{l}
mev(t48, bel(spx, when(e46, on([td47, td48])))).\\
mev(t48, bel(spx, what(e46, bring(p4, c42)))).\\
mev(t412, bel(spx, when(e48, on([td411, td412])))).\\
mev(t410, bel(spx, what(e47, wear(p3, c43, c44)))).\\
mev(t410, bel(spx, when(e47, on([td49, td410])))).\\
mev(t412, bel(spx, what(e48, wear(p4, c45, c46)))).
\end{array}
$$

The spectator can observe the briefcase$_{c42}$ that Jules has, and believes$_{mx}$ that it is the same briefcase that Jules and Vincent have taken from the group of guys:

$$bel(spx, same(c42, c31)).$$

mental event previously recorded in the spectator's cognitive state with the beliefs:

$$
\begin{array}{l}
bel(spx, when(e31, on([td31, td32]))).\\
bel(spx, what(e31, get(p3, c31)).\\
bel(spx, who(e31, p3).
\end{array}
$$

In this macro event it is applied the causal rule 5.4.1 given in chapter 5, instanziated for $Ev1{=}e31$, $Ev2{=}e46$:

$$
\begin{array}{l}
mev(t48, bel(spx, prec(e31, e46))) \leftarrow\\
\ mev(t48, bel(spx, e31)),\\
\ mev(t48, bel(spx, cause(e31, e46)))
\end{array}
$$

where $mev(t48, bel(spx, cause(e31, e46)))$ represents the implication "if in that moment Jules brings the briefcase is because it has picked up". The consequence of the rule is that the spectator acquires the temporal belief that the event $e31$ precedes the event $e46$. This belief is fundamental as it puts in relation the events S3 with the ones in S4. You can see that before Jules and Vincent enter in the Wallace's bar (group of event S4), all the events present in S4 have formed a hypothetic ellipsis – this rule of anchoring constitutes the fitting between the events S3 and the ones of S4. Jules and Vincent's strange way of dressing (events e47, e48) will be, as we see, the condition that allows the spectator to make an important temporal anchoring – a deixis for repetition of events –during the vision of the movie final macro event where Jules and Vincent will wear the same strange clothes.

S5 - THE DRUG DEALER ($e5x$)**.** Vincent$_{p3}$ is at the house$_{w52}$ of a drug dealer$_{p9}$ to buy$_{e51}$ some drug$_{c51}$. Vincent$_{p3}$ is driving$_{e52}$ a car$_{c53}$.

$$mev(t52, bel(spx, when(e51, on([td51, td52])))).$$
$$mev(t54, bel(spx, when(e52, on([td53, td54])))).$$
$$mev(t52, bel(spx, what(e51, buy(p3, c51)))).$$
$$mev(t54, bel(spx, what(e52, drive(p3, c53)))).$$
$$mev(t52, bel(spx, where(w52))).$$
$$mev(t52, bel(spx, who(e51, p3))).$$
$$mev(t52, bel(spx, who(e51, p9))).$$

The event $e51$ of the sequence S5 is a hypothetical ellipsis and for this reason in not anchored to the other part of the story. All the events $e5x$ are anchored among them for causality, but are not anchored to other events of the story. The anchoring will not be performed until Vincent does not come to Mia's house. I will comment this link in the analysis in the next macro event.

S6 - MIA ($e6x$)**.** Vincent$_{p3}$ arrives$_{e61}$ at Mia$_{p5}$'s house$_{w61}$. Vincent$_{p3}$ takes$_{e62}$ a drink$_{c62}$ at Mia$_{p5}$'s house$_{c61}$ and they are going$_{e63}$ to dinner.

$$mev(t62, bel(spx, when(e61, on([td61, td62])))).$$
$$mev(t62, bel(spx, where(e61, w61))).$$
$$mev(t62, bel(spx, who(e61, p3)))$$
$$mev(t64, bel(spx, what(e62, take_drink(p3, c62)))).$$
$$mev(t64, bel(spx, who(e62, p3))).$$

$$mev(t62, bel(spx, what(e61, arrive(p3, w61)))).$$
$$mev(t62, bel(spx, who(e61, p5))).$$
$$mev(t64, bel(spx, when(e62, on([td63, td64])))).$$
$$mev(t64, bel(spx, where(e62, w61))).$$
$$mev(t64, bel(spx, who(e62, p5))).$$

This last macro event presents a significant temporal anchoring that derives from the rule that the time in which it is uttered the happening of an event, is always previous to the time in which the same event happens. In the sequence S2 the spectator has recorded the belief:

$$mev(t26, addBel(bel(spx, when(e25, after([td25, td26])))))$$
$$mev(t26, addBel(bel(spx, what(e25, dine(p3, p5))))).$$

that is, Vincent and Mia are going out for dinner ($e25$) in a no determined future, after the break $[td25, td26]$.

In sequence S6 the spectator records the belief relative the event $e63$, that is:

$$\begin{array}{l}
\mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathit{when}(e63, \mathtt{on}([\mathtt{td65}, \mathtt{td66}])))).\\
\mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathit{what}(e63, \mathtt{dine}(\mathtt{p3}, \mathtt{p5})))).\\
\mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathit{who}(e63, \mathtt{p3}))).\\
\mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathit{who}(e63, \mathtt{p5}))).
\end{array}$$

For such events I instantiate the rule 5.5.3 in 5.5.2:

$$\begin{array}{l}
\mathit{mev}(\mathtt{t66}, \mathtt{addBel}(\mathtt{bel}(\mathtt{spx}, \mathtt{prec}([\mathtt{td25}, \mathtt{td26}], [\mathtt{td65}, \mathtt{td66}])))) \leftarrow\\
\quad \mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathit{when}(e25, \mathtt{after}([\mathtt{td25}, \mathtt{td26}])))),\\
\quad \mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathit{when}(e63, \mathtt{on}([\mathtt{td65}, \mathtt{td66}])))),\\
\quad \mathit{mev}(\mathtt{t66}, \mathtt{bel}(\mathtt{spx}, \mathtt{sameE}(e63, e25))).
\end{array}$$

Vincent$_{\mathrm{p3}}$ and Mia$_{\mathrm{p5}}$ are talking$_{e4}$ in the restaurant$_{w63}$.

$$\begin{array}{l}
\mathit{mev}(\mathtt{t68}, \mathtt{bel}(\mathtt{spx}, \mathit{when}(e64, \mathtt{on}([\mathtt{td67}, \mathtt{td68}]))))\\
\mathit{mev}(\mathtt{t68}, \mathtt{bel}(\mathtt{spx}, \mathit{what}(e64, \mathtt{talk}(\mathtt{p3}, \mathtt{p5}))))\\
\mathit{mev}(\mathtt{t68}, \mathtt{bel}(\mathtt{spx}, \mathit{where}(e64, w63))).\\
\mathit{mev}(\mathtt{t68}, \mathtt{bel}(\mathtt{spx}, \mathit{who}(e64, \mathtt{p5}))).\\
\mathit{mev}(\mathtt{t68}, \mathtt{bel}(\mathtt{spx}, \mathit{who}(e64, \mathtt{p3}))).
\end{array}$$

S7 - THE DANCE ($e7x$**).** Vincent$_{\mathrm{p3}}$ and Mia$_{\mathrm{p5}}$ are dancing$_{e71}$ in the restaurant$_{e63}$.

Figure 10.0.3: Vincent dancing with Mia

$$\begin{array}{l}
\mathit{mev}(\mathtt{t72}, \mathtt{bel}(\mathtt{spx}, \mathit{when}(e71, \mathtt{on}([\mathtt{td71}, \mathtt{td72}])))).\\
\mathit{mev}(\mathtt{t72}, \mathtt{bel}(\mathtt{spx}, \mathit{what}(e71, \mathtt{dance}(\mathtt{p3}, \mathtt{p5})))).\\
\mathit{mev}(\mathtt{t72}, \mathtt{bel}(\mathtt{spx}, \mathit{who}(e71, \mathtt{p5}))).\\
\mathit{mev}(\mathtt{t72}, \mathtt{bel}(\mathtt{spx}, \mathit{what}(e71, \mathtt{dance}(\mathtt{p3}, \mathtt{p5})))).
\end{array}$$

$$\begin{array}{l}
\mathit{mev}(\mathtt{t72}, \mathtt{bel}(\mathtt{spx}, \mathit{who}(e71, \mathtt{p3}))).\\
\mathit{mev}(\mathtt{t72}, \mathtt{bel}(\mathtt{spx}, \mathit{where}(w63))).
\end{array}$$

S8 - OVERDOSE ($e8x$)**.** Mia and Vincent are at Mia's house$_{w61}$. Mia$_{p5}$ is overdosed$_{e81}$.

$mev(t82, bel(spx, when(e81, on([td81, td82]))))$.
$mev(t82, bel(spx, what(e81, being_overdose(p5))))$.
$mev(t82, bel(spx, where(w61)))$.
$mev(t82, bel(spx, who(e81, p3)))$.
$mev(t82, bel(spx, who(e81, p5)))$.

S9 - RESCUE ($e9x$)**.** Vincent$_{p3}$ takes$_{e91}$ Mia$_{p5}$ to drug dealer$_{p9}$'s house$_{w52}$. Mia$_{p5}$ is saved$_{e92}$ by using a syringe$_{c91}$. Mia and Vincent are outside Mia's house$_{c61}$ - Mia$_{p5}$ tells$_{e93}$ Vincent$_{p3}$ the joke$_{c92}$ of the tomato. Vincent$_{p3}$ and Mia$_{p5}$ greet$_{e94}$ each other.

$mev(t92, bel(spx, when(e91, on([td91, td92]))))$.
$mev(t92, bel(spx, what(e91, bring(p3, p5, w52))))$.
$mev(t92, bel(spx, where(e91, w52)))$.
$mev(t92, bel(spx, who(e91, p3)))$.
$mev(t92, bel(spx, who(e91, p4)))$.
$mev(t92, bel(spx, who(e91, p9)))$.
$mev(t98, bel(spx, when(e94, on([td97, td98]))))$.
$mev(t98, bel(spx, what(e94, greet(p3, p5))))$.

$mev(t94, bel(spx, when(e92, on([td93, td94]))))$.
$mev(t94, bel(spx, what(e92, salve(p5, c91))))$.
$mev(t96, bel(spx, when(e93, on([td95, td96]))))$.
$mev(t96, bel(spx, what(e93, tell(p5, c92))))$.
$mev(t96, bel(spx, where(e93, w61)))$.
$mev(t96, bel(spx, who(e93, p3)))$.
$mev(t96, bel(spx, who(e93, p5)))$.

S10 - THE WATCH ($e10x$)**.** A child$_{p81}$ watches$_{e101}$ TV - the child's name is Butch. Captain Koons$_{p10}$ tells$_{e102}$ the story$_{c101}$ of the watch$_{c102}$ and about how many sacrifices Butch's ancestors have done to retain him to successive generations. Captain Koons$_{p10}$ gives$_{e103}$ Butch$_{p81}$ the gold watch$_{c102}$ that Butch's father has bequeathed.

$mev(t102, bel(spx, when(e101, on([td101, td102]))))$.
$mev(t102, bel(spx, what(e101, watch(p81, tv))))$.
$mev(t102, bel(spx, who(e101, p81)))$.
$mev(t104, bel(spx, when(e102, on([td103, td104]))))$.
$mev(t104, bel(spx, what(e102, tell(p10, c101))))$.
$mev(t104, bel(spx, who(e102, p81)))$.

$mev(t104, bel(spx, who(e102, p10)))$.
$mev(t106, bel(spx, when(e103, [td105, td106])))$.
$mev(t106, bel(spx, who(e103, p81)))$.
$mev(t106, bel(spx, what(e103, deliver(p10, p81, c102))))$.
$mev(t106, bel(spx, who(e103, p10)))$.

After the vision of the event $e101$, spx acquires the following beliefs:

$mev(t102, bel(spx, who(e101, p81)))$.
$mev(t102, bel(spx, propEv(e101, name(p81, ''Butch''))))$.
$mev(t102, bel(spx, propEv(e101, age(p81, child))))$.

The boxer$_{p82}$ wakes up$_{e104}$ on the couch$_{c103}$ in a dressing room$_{w104}$. The boxer$_{p82}$'s name is Butch. A radio$_{c105}$ is reporting$_{e105}$ that Butch$_{p82}$ has won a boxing match$_{e106}$. Butch$_{p82}$ catches$_{e107}$ a taxi$_{c106}$. Butch$_{p82}$ is preparing$_{e108}$ to leave the country.

$mev(t102, bel(spx, propEv(e101, name(p81, ''Butch''))))$.
$mev(t102, bel(spx, who(e101, p81)))$.
$mev(t102, bel(spx, propEv(e101, age(p81, child))))$.
$mev(t108, bel(spx, when(e104, on([td107, td108]))))$.
$mev(t108, bel(spx, what(e104, wakeUp(p81, c103))))$.
$mev(t108, bel(spx, where(e104, w104)))$.
$mev(t108, bel(spx, who(e104, p81)))$.
$mev(t110, bel(spx, when(e106, before([td109, td110]))))$.
$mev(t110, bel(spx, what(e106, win(p81, boxinMatch))))$.
$mev(t110, bel(spx, who(e106, p81)))$.

$mev(t114, bel(spx, when(e108, on([td113, td114]))))$.
$mev(t114, bel(spx, what(e108, prepare(p8, leaveCountry))))$.
$mev(t114, bel(spx, who(e108, p81)))$.
$mev(t110, bel(spx, when(e105, on([td109, td110]))))$.
$mev(t110, bel(spx, what(e105, say(c105, e106))))$.
$mev(t110, bel(spx, who(e105, c105)))$.
$mev(t112, bel(spx, when(e107, on([td111, td112]))))$.
$mev(t112, bel(spx, who(e22, p81)))$.
$mev(t112, bel(spx, what(e22, take(p81, c106))))$.

After the vision of the event $e104$ spx acquires the following beliefs:

$mev(t108, bel(spx, when(e104, on([td107, td108]))))$.
$mev(t108, bel(spx, who(e104, p82)))$.
$mev(t108, bel(spx, what(e104, wakeUp(p82, c103))))$.
$mev(t108, bel(spx, where(e104, w104)))$.
$mev(t108, bel(spx, propEv(e104, name(p82, ''Butch''))))$.
$mev(t108, bel(spx, propEv(e104, age(p82, adult))))$.

spx reaches the conclusion that the event $e101$ precedes $e104$, firstly by applying the inference "same, name then same, character" 2.4.9 (sec. 5.6):

$mev(t108, bel(spx, sameP(p81, p82))) \leftarrow$
$mev(t108, bel(spx, who(e101, p81)))$,
$mev(t108, bel(spx, who(e104, p82)))$,
$mev(t108, bel(spx, propEv(e101, prop(name, p81, ''Butch''))))$,
$mev(t108, bel(spx, propEv(e104, prop(name, p82, ''Butch''))))$,
$mev(t108, bel(spx, sameV(''Butch'', ''Butch'')))$.

then by applying the inference 5.6.2 introduced in 5.6:

$$
\begin{aligned}
&mev(t108, bel(spx, prec(e101, e104))) \leftarrow \\
&\ mev(t108, bel(spx, who(e101, p81))), \\
&\ mev(t108, bel(spx, who(e104, p82))), \\
&\ mev(t108, bel(spx, provEv(e101, prop(age, p81, child))), \\
&\ mev(t108, bel(spx, provEv(e104, prop(age, p82, adult))), \\
&\ mev(t108, bel(spx, sameP(p81, p82))).
\end{aligned}
$$

In this macro event $e10x$ there is an important temporal anchoring, that is an instance of the cognitive rule 5.3.4 (in section 5.3):

$$
\begin{aligned}
&mev(t108, bel(spx, prec(e43, e105))) \leftarrow \\
&mev(t108, bel(spx, who(e105, mx))), \\
&mev(t108, bel(spx, media(mx))), \\
&mev(t108, bel(spx, when(e105, on([td109, td110])))), \\
&mev(t108, bel(spx, what(e105, tell(mx, e106)))) \\
&mev(t108, bel(spx, when(e106, before([td109, td110])))), \\
&\qquad \text{\% e105 reports the news using a past time,} \\
&mev(t108, bel(spx, sameE(e106, e43))). \\
&\qquad \text{\% there is identity between e106 and e43}
\end{aligned}
$$

spx believes e105 precedes e43 if spx believes that: mx takes part in the event e105, 'e105 happens on [td109 , td110], e105 happens on [td109 , td110], mx reports the news e106, mx reports the news e106. e105 reports the news using a past time,here is identity between e106 and e43.

S11 - FABIENNE ($e11x$). Butch$_{p8}$ reaches$_{e111}$ the motel where Fabienne$_{p11}$ is.

S12 - DISTRACTION ($e12x$). Butch$_{p8}$, unsuccessfully, looks$_{e121}$ for the clock$_{c102}$ in the bag$_{w121}$. Butch$_{p8}$ gets angry$_{e122}$ with Fabienne$_{p11}$. Butch$_{p8}$

goes$_{e123}$ home$_{w122}$. Butch$_{p8}$ sees$_{e124}$ a machine gun$_{c123}$ in the kitchen$_{w124}$. Butch$_{p8}$ hears$_{e125}$ the sound of water$_{c125}$ from the bathroom$_{w126}$.

$mev(t122, bel(spx, when(e121, on([td121, td122])))).$
$mev(t122, bel(spx, what(e121, try(p8, c102)))).$
$mev(t122, bel(spx, where(e121, w121))).$
$mev(t122, bel(spx, who(e121, p8))).$
$mev(t124, bel(spx, when(e122, on([td123, td124])))).$
$mev(t124, bel(spx, what(e122, getAngry(p8, p11)))).$

$mev(t126, bel(spx, when(e123, on([td125, td126])))).$
$mev(t128, bel(spx, when(e124, on([td127, td128])))).$
$mev(t126, bel(spx, what(e123, go(p8, c122)))).$
$mev(t128, bel(spx, what(e124, see(p8, c123)))).$
$mev(t126, bel(spx, where(e123, w122))).$
$mev(t128, bel(spx, where(e124, w124))).$
$mev(t126, bel(spx, who(e123, p3))).$
$mev(t126, bel(spx, who(e123, p4))).$
$mev(t128, bel(spx, who(e124, p8))).$
$mev(t1210, bel(spx, when(e125, [td129, td1210]))).$
$mev(t1210, bel(spx, what(e125, hear(p8, c125)))).$
$mev(t1210, bel(spx, where(e125, w126))).$
$mev(t1210, bel(spx, who(e125, p8))).$

S13 - VINCENT'S DEATH ($e13x$). Butch$_{p8}$ shoots$_{e131}$ Vincent$_{p3}$. Vincent$_{p3}$ dies$_{e132}$.

$mev(t132, bel(spx, when(e131, on([td131, td132])))).$
$mev(t134, bel(spx, when(e132, on([td133, td134])))).$
$mev(t132, bel(spx, what(e131, shoot(p8, p3)))).$
$mev(t134, bel(spx, what(e132, die(p3)))).$
$mev(t132, bel(spx, who(e131, p8))).$
$mev(t132, bel(spx, who(e131, p3))).$

Figure 10.0.4: Vincent dies

S14 - AT THE TRAFFIC LIGHTS ($e14x$). On the way back, he is about to reach Fabienne and leave the country together. Butch$_{p8}$ meets$_{e141}$ Wallace$_{p7}$. Butch$_{p8}$ and Wallace$_{p7}$ try to kill$_{e142}$ each other. Wallace$_{p7}$ and Butch$_{p8}$ are seized$_{e143}$ in a store$_{w141}$ by Maynard master$_{p12}$.

$mev(t142, bel(spx, when(e141, on([td141, td142])))).$
$mev(t146, bel(spx, when(e143, on([td145, td146])))).$
$mev(t142, bel(spx, what(e141, meet(p8, p7)))).$
$mev(t146, bel(spx, what(e143, seize(p12, p7, p8)))).$
$mev(t142, bel(spx, who(e141, p3))).$
$mev(t146, bel(spx, where(e143, w141))).$
$mev(t142, bel(spx, who(e141, p4))).$
$mev(t146, bel(spx, who(e143, p7))).$
$mev(t144, bel(spx, when(e142, on([td143, td144])))).$
$mev(t146, bel(spx, who(e143, p8))).$
$mev(t144, bel(spx, what(e142, kill(p8, p7)))).$
$mev(t146, bel(spx, who(e143, p12))).$
$mev(t144, bel(spx, who(e142, p7))).$
$mev(t144, bel(spx, who(e142, p8))).$

S15 - THE VIOLENCE ($e15x$). Zed$_{p13}$ chooses$_{e151}$ Wallace$_{p7}$ as his first victim.

$mev(t152, bel(spx, when(e151, on([td151, td152])))).$
$mev(t152, bel(spx, what(e151, choose(p13, p7)))).$
$mev(t152, bel(spx, who(e151, p7))).$
$mev(t152, bel(spx, who(e151, p13))).$

S16 - THE REVENGE ($e16x$). Butch$_{p8}$ wriggles away$_{e161}$ from the shop$_{w141}$. Butch$_{p8}$ decides to rescue$_{e162}$ Wallace$_{p7}$. Butch$_{p8}$ saves$_{e163}$ Wallace$_{p7}$ from Zed$_{p13}$ and Maynard$_{p12}$. Wallace$_{p7}$ declares truce$_{e164}$ with Butch$_{p8}$. Butch$_{p8}$ makes commitment$_{e165}$ with Wallace$_{p7}$ to leave the country$_{e166}$. Butch$_{p8}$ returns to pick up$_{e167}$ Fabienne$_{p11}$.

$mev(t162, bel(spx, when(e161, on([td161, td162])))).$
$mev(t162, bel(spx, what(e161, freeEscape(p8)))).$
$mev(t162, bel(spx, where(e161, w141))).$
$mev(t162, bel(spx, who(e161, p8))).$
$mev(t164, bel(spx, when(e162, on([td163, td164])))).$
$mev(t164, bel(spx, what(e162, decideRescue(p8, e163)))).$
$mev(t164, bel(spx, who(e162, p3))).$
$mev(t164, bel(spx, who(e162, p4))).$

```
mev(t166, bel(spx, when(e163, on([td165, td166])))).
mev(t166, bel(spx, what(e163, save(p8, p7)))).
mev(t166, bel(spx, who(e163, p7))).
mev(t166, bel(spx, who(e163, p8))).
mev(t166, bel(spx, who(e163, p12))).
mev(t166, bel(spx, who(e163, p13))).
mev(t168, bel(spx, when(e164, on([td167, td168])))).
mev(t168, bel(spx, who(e164, p7))).
mev(t168, bel(spx, what(e164, declareTruce(p7, p8)))).
mev(t168, bel(spx, who(e164, p8))).
mev(t168, bel(spx, who(e164, p8))).
```

```
mev(t1610, bel(spx, when(e165, on([td169, td1610])))).
mev(t1610, bel(spx, what(e165, cmt(p8, p7, e166)))).
mev(t1610, bel(spx, who(e165, p7))).
mev(t1610, bel(spx, who(e165, p8))).
mev(t1610, bel(spx, when(e166, after([td169, td1610])))).
mev(t1610, bel(spx, what(e166, leave(p8, country)))).
mev(t1610, bel(spx, who(e166, p8))).
mev(t1612, bel(spx, when(e167, on([td1611, td1612])))).
mev(t1612, bel(spx, what(e167, take(p8, p11)))).
mev(t1612, bel(spx, who(e167, p8))).
mev(t1612, bel(spx, who(e167, p11))).
```

S17 - MIRACLE ($e17x$). Behind a closed door there is a young man$_{p14}$ who listens$_{e171}$ to what it is said in a hotel room$_{w171}$. Jules$_{p4}$ plays$_{e172}$ the verse of the Ezekiel Bible 25,17$_{c172}$. At the end of the reading Vincent$_{p3}$ and Jules$_{p4}$ shoot$_{pe173}$ Brett$_{p6}$.

```
mev(t172, bel(spx, when(e171, on([td171, td172])))).
mev(t172, bel(spx, what(e171, hear(p14, w171)))).
mev(t172, bel(spx, who(e171, p4))).
mev(t172, bel(spx, who(e171, p14))).
mev(t176, bel(spx, when(e173, on([td175, td176])))).
mev(t176, bel(spx, what(e173, shoot(p3, p4, p6)))).
mev(t176, bel(spx, who(e173, p3))).
mev(t176, bel(spx, who(e173, p4))).
mev(t176, bel(spx, who(e173, p14))).
```

```
mev(t174, bel(spx, when(e172, on([td173, td174])))).
mev(t174, bel(spx, what(e172, recite(p4, c172)))).
mev(t174, bel(spx, where(e172, w171))).
mev(t174, bel(spx, who(e172, p3))).
mev(t174, bel(spx, who(e172, p4))).
mev(t174, bel(spx, who(e172, p6))).
mev(t174, bel(spx, who(e172, p14))).
mev(t176, bel(spx, who(e173, p6))).
```

In this sequence, as the action of the reading the Ezekiel verse 25,17 is very specific (see these kind of inferences in paragraph 5), the spectator be-

Figure 10.0.5: The bullets do not hit Jules

lieves that the event associated to such action is a repetition of the event of the reading of Ezekiel's verse in the sequence $S3$. In other words:

$$\mathrm{bel}(spx, rep(e33, e172)).$$

The belief just given is a basic condition for spx to anchor the events $e33$ and $e172$, where spx believes that events $e33$ and $e172$ happen on the same temporal interval. This last inference is an instance of the rule 5.3.2, substituting $e33$ and $e172$ to the respective variables:

$$\begin{array}{l} mev(e172, bel(spx, eq(e33, e172))) \leftarrow \\ \quad mev(e172, bel(spx, e33)), \\ \quad mev(e172, bel(spx, e172)), \\ \quad mev(e172, bel(spx, rep(e33, e172))). \end{array}$$

The episode continues with the following filmic events. A fourth man_{p14} comes out_{e174} from the bathroom_{w173} and shoots_{e175} a loader_{c174} on Jules_{p4} and Vincent_{p3}. The bullets_{c175} in an inexplicable manner go through_{e176} Jules_{p4} and Vincent's_{p3} bodies without strucking them (e50). Jules_{p4} and Vincent_{p3} answer to the fire_{e177} and kill_{e178} the fourth man_{p14} who was coming out of the bathroom. Jules$_{p4}$ and Vincent$_{p3}$ take away$_{e179}$ Marvin$_{p15}$ (the only survivor among the young men).

```
mev(t178, bel(spx, when(e174, on([td177, td178])))).
mev(t178, bel(spx, what(e174, comeOut(p14, w173)))).
mev(t178, bel(spx, where(e174, w173))).
mev(t178, bel(spx, who(e174, p14))).

mev(t1710, bel(spx, when(e175, on([td179, td1710])))).
mev(t1710, bel(spx, what(e175, shoot(p14, p3, p4)))).
mev(t1710, bel(spx, who(e175, [p3, p4]))).
mev(t178, bel(spx, who(e174, p14))).

mev(t1712, bel(spx, when(e176, on([td1711, td1712])))).
mev(t1712, bel(spx, what(e176, passThrough(c175, p3, p4)))).
mev(t1712, bel(spx, who(e176, p3))).
mev(t1712, bel(spx, who(e176, p4))).

mev(t1712, bel(spx, when(e176, on([td1711, td1712])))).
mev(t1712, bel(spx, what(e176, passThrough(c175, p3, p4)))).
mev(t1712, bel(spx, who(e176, p3))).
mev(t1712, bel(spx, who(e176, p4))).

mev(t1714, bel(spx, when(e177, on([td1713, td1714])))).
mev(t1714, bel(spx, what(e177, shoot(p3, p4, p14)))).
mev(t1714, bel(spx, who(e177, p3))).
mev(t1714, bel(spx, who(e177, p4))).

mev(t1716, bel(spx, when(e178, on([td1715, td1716])))).
mev(t1716, bel(spx, what(e178, kill(p3, p4, p14)))).
mev(t1716, bel(spx, who(e178, p3))).
mev(t1716, bel(spx, who(e178, p4))).
mev(t1716, bel(spx, who(e178, p14))).

mev(t1718, bel(spx, when(e179, on([td1717, td1718])))).
mev(t1718, bel(spx, what(e179, takeAway(p3, p4, p15)))).
mev(t1718, bel(spx, who(e179, p3))).
mev(t1718, bel(spx, who(e179, p4))).
mev(t1718, bel(spx, who(e179, p15))).
```

S18 - THE ERROR (e18x)**.** Accidentally Vincent$_{p3}$ kills$_{e181}$ Marvin$_{p14}$ in the car$_{w21}$. Jules$_{p4}$ calls$_{e182}$ Jimmie$_{p16}$ to be helped.

```
mev(t182, bel(spx, when(e181, on([td181, td182])))).
mev(t182, bel(spx, what(e181, kill(p3, p14)))).
mev(t182, bel(spx, where(e181, w21))).
mev(t182, bel(spx, who(e181, p3))).
mev(t182, bel(spx, who(e181, p4))).
mev(t182, bel(spx, who(e181, p14))).

mev(t184, bel(spx, when(e182, on([td183, td184])))).
mev(t184, bel(spx, what(e182, call(p4, p16)))).
mev(t184, bel(spx, who(e182, p4))).
mev(t184, bel(spx, who(e182, p16))).
```

S19 - JIMMIE ($e19x$)**.** Vincent$_{p3}$ and Jules$_{p4}$ wash$_{e191}$ their hands in the Jimmie$_{p16}$'s bathroom$_{w191}$. Vincent$_{p3}$ and Jules$_{p4}$ argue$_{e192}$ with Jimmie$_{p16}$ in Jimmie$_{p16}$'s kitchen$_{w192}$. Jimmie$_{p16}$ says$_{e193}$ to Vincent$_{p3}$ and Jules$_{p4}$ that at 9:30 his wife Bonnie$_{p17}$ will back$_{e194}$ home$_{c193}$.

$mev(t192, bel(spx, when(e191, on([td191, td192])))).$
$mev(t192, bel(spx, what(e191, wash(p3, p4)))).$
$mev(t192, bel(spx, where(e191, w191))).$
$mev(t192, bel(spx, who(e191, p3))).$
$mev(t192, bel(spx, who(e191, p4))).$
$mev(t192, bel(spx, who(e191, p16))).$
$mev(t196, bel(spx, when(e193, on([td195, td196])))).$
$mev(t196, bel(spx, what(e193, say(p16, p3, p4, e194)))).$
$mev(t196, bel(spx, where(e193, w192))).$
$mev(t196, bel(spx, who(e193, p3))).$
$mev(t196, bel(spx, who(e193, p4))).$
$mev(t196, bel(spx, who(e193, p16))).$

$mev(t194, bel(spx, when(e192, on([td193, td194])))).$
$mev(t194, bel(spx, what(e192, argue(p3, p4, p16)))).$
$mev(t194, bel(spx, where(e192, w192))).$
$mev(t194, bel(spx, who(e192, p3))).$
$mev(t194, bel(spx, who(e192, p4))).$
$mev(t194, bel(spx, who(e192, p16))).$
$mev(t196, bel(spx, when(e194, after([td195, td196])))).$
$mev(t196, bel(spx, what(e194, back(p17, w193)))).$
$mev(t196, bel(spx, where(e194, w193))).$
$mev(t196, bel(spx, who(e194, p17))).$

S20 - THE REINFORCEMENTS ($e20x$)**.** Jules$_{p4}$ calls$_{e201}$ Wallace$_{p7}$ to ask for reinforcements. Wallace$_{p7}$ says$_{e202}$ that Jules$_{p4}$ will send$_{e203}$ Wolf$_{p18}$ to support him. Wolf$_{p18}$ on the phone receives$_{204}$ detailed information about the problem.

$mev(t202, bel(spx, when(e201, on([td201, td202])))).$
$mev(t202, bel(spx, what(e201, call(p4, p7)))).$
$mev(t202, bel(spx, who(e201, p3))).$
$mev(t202, bel(spx, who(e201, p4))).$
$mev(t202, bel(spx, who(e201, p16))).$
$mev(t204, bel(spx, when(e203, after([td203, td204])))).$
$mev(t204, bel(spx, what(e203, send(p7, p18)))).$
$mev(t204, bel(spx, who(e203, p7))).$

$mev(t204, bel(spx, who(e203, p18))).$
$mev(t204, bel(spx, what(e202, say(p7, p4, e203)))).$
$mev(t204, bel(spx, who(e202, p4))).$
$mev(t204, bel(spx, who(e202, p7))).$
$mev(t204, bel(spx, who(e202, p18))).$
$mev(t196, bel(spx, when(e204, after([td195, td196])))).$
$mev(t196, bel(spx, what(e204, receive(p18)))).$

S21 - WOLF ($e21x$). Wolf$_{p18}$ arrives$_{e201}$ at Jimmy$_{p16}$'s house$_{w193}$. Vincent$_{p3}$ and Jules$_{p16}$ clean$_{e212}$ the car$_{w21}$. Vincent$_{p3}$ and Jules$_{p4}$ change$_{e213}$ their clothes. Vincent$_{p3}$ wears$_{e214}$ a white t-shirt$_{c211}$ and blue shorts$_{c212}$. Jules$_{p4}$ wears$_{e215}$ a light blue t-shirt$_{c213}$ and red shorts$_{c214}$. Vincent$_{p3}$, Jules$_{p4}$ and Wolf$_{p18}$ take$_{e216}$ the car$_{w21}$ with the corpse$_{p15}$ by the junkyard "Monster Joe"$_{w215}$.

```
mev(t212, bel(spx, when(e211, on([td211, td212])))).
mev(t212, bel(spx, what(e211, arrive(p18, w193)))).
mev(t212, bel(spx, where(e211, w193))).
mev(t212, bel(spx, who(e211, p16))).
mev(t212, bel(spx, who(e211, p18))).
mev(t216, bel(spx, when(e213, on([td215, td216])))).
mev(t216, bel(spx, what(e213, chance(p3, p4)))).
mev(t216, bel(spx, who(e213, p3))).
mev(t216, bel(spx, who(e213, p4))).
mev(t2110, bel(spx, when(e215, on([td219, td2110])))).
mev(t2110, bel(spx, what(e215, wear(p4, c213, c214)))).
mev(t2112, bel(spx, who(e216, p4))).
mev(t2112, bel(spx, who(e216, p18))).

mev(t214, bel(spx, when(e212, on([td213, td214])))).
mev(t214, bel(spx, what(e212, clean(p3, p4, w21)))).
mev(t214, bel(spx, where(e212, w21))).
mev(t214, bel(spx, who(e212, p3))).
mev(t214, bel(spx, who(e212, p4))).
mev(t218, bel(spx, when(e214, on([td217, td218])))).
mev(t218, bel(spx, what(e214, wear(p3, c211, c212)))).
mev(t2112, bel(spx, where(e216, w215))).
mev(t2112, bel(spx, who(e216, p3)))
mev(t2112, bel(spx, who(e216, p15))).
```

S22 - AT BREAKFAST ($e22x$). Jules$_{p4}$ and Vincent$_{p3}$ have breakfast$_{e221}$ in a bar$_{w221}$. A young man$_{p1}$[1] says$_{e222}$ "Garcon, coffee"$_{f4}$.

```
mev(t222, bel(spx, when(e221, on([td221, td222])))).
mev(t222, bel(spx, what(e221, doBreakfast(p3, p4)))).
mev(t222, bel(spx, where(e221, w221))).
mev(t222, bel(spx, who(e221, p3))).
mev(t222, bel(spx, who(e221, p4))).
mev(t224, bel(spx, when(e222, on([td223, td224])))).
mev(t224, bel(spx, what(e222, say(p1, f4)))).
mev(t224, bel(spx, what(e222, say(p1, f4)))).
mev(t224, bel(spx, where(e222, w221))).
mev(t224, bel(spx, who(e222, p1))).
```

1 In annotating these events, I have used the subscript p1, p2 for the young man and the young woman, the same that have been used at the beginning of the telling. In a rigorous manner it was needed to generate two new indices p11, p22 and add two relations of the belief bel(spx, sameP(p1, p11)) and bel(spx, sameP(p2, p22)), this also for the characters p3 and p4 (Vincent and Jules)

S23 - THE ROBBERY ($e23x$). A young man$_{p1}$ holds$_{e231}$ a gun$_{c231}$. The man$_{p1}$ says$_{e232}$ "Nobody move, this is a robbery"$_{f5}$. The woman$_{p2}$ says$_{e233}$ "and if by chance any of you dares to move, I will do all dried up last, ugly son of a bitch, do you understand?"$_{f6}$

Jules$_{p4}$ threatens$_{e234}$ the young man$_{p1}$ with the gun$_{c231}$. Jules$_{p4}$ forces$_{e235}$ the young$_{p1}$ man and the young woman$_{p2}$ to surrender. Jules$_{p4}$ plays$_{e236}$ the verse Ezekiel 25-17$_{c32}$. Jules$_{p4}$ invites the young robber$_{p1}$ and the young woman$_{p2}$ to leave the bar$_{e237}$. He interprets the episode of the bullets, going through his body without striking him, as a God's sign to make him thinking about his way of living, and to suggest a radical change.

$$mev(t232, bel(spx, when(e231, on([td231, td232])))).$$
$$mev(t232, bel(spx, what(e231, say(p1a, f3)))).$$
$$mev(t232, bel(spx, where(e231, w221))).$$
$$mev(t232, bel(spx, who(e231, p1a))).mev(t232, bel(spx, who(e231, p2a))).$$

The event $e231$ is obviously a repetition of the event $e15$:

$$when(e15, on([td19, td110])).\ what(e15, say(p1, f2)).$$
$$where(e15, w11),\ who(e15, p1).\ who(e15, p2).$$

The spectator has recognized the young woman and the young boy with the gun, he believes they are the same characters – ($bel(spx, sameP(p11, p1))$ and $bel(spx, sameP(p21, p2))$) – moreover the spectator believes it has been uttered the same sentence ($bel(spx, saleF(f3, f2))$) in the two events we are comparing. The spectator concludes that $e231$ is a repetition of events $e15$, for the specificity of the attributes of the same events (see paragraph 5.5): same participants (who), same actions (what), same places (where).

$$bel(spx, sameF(f1, f5)).\ bel(spx, sameW(w11, w221)).\ bel(spx, [p1, p2] \text{ is } [p1a, p2a])$$

for the 5.2.2 (in section 5.2) is then valid $bel(Spx, rep(e15, e231)$. In the end, being the belief a repetition of an event, it is valid that the spectator believes that the event $e15$ and its repetition $e231$ occur on the same temporal interval.

$$\begin{aligned}&mev(T4, bel(spx, prec(e15, e231))) \leftarrow\\&\ mev(T1, bel(spx, e15)),\\&\ mev(T2, bel(spx, e231)),\\&\ mev(T3, bel(spx, rep(e15, e231))).\end{aligned}$$

S24 - FINAL ($e24x$). Jules$_{p4}$ and Vincent$_{p3}$ come out$_{e241}$ of the bar with the briefcase$_{c31}$. Vincent$_{p3}$ wears$_{e242}$ a white t-shirt$_{c211}$ and blue shorts$_{c212}$. Jules$_{p4}$ wears$_{e243}$ a light blue t-shirt$_{c213}$ and red shorts$_{c214}$.

11 FRAGMENTATION MEASURES OF *PULP FICTION*, *MEMENTO* AND *THE ENGLISH PATIENT* - BY GIANLUCA CODA, AND PAOLO VANACORE

The semantic annotation of a filmic text increases the competence to analyze the stories of movies. The annotation process requires greater rigor in the selection of story events, and the result consists in an annotated corpus of events allowing to formally analyze global structural entities, such as the focalization and fragmentation of a story.

Time of narration	who (participants list)	where (locations)	what (actions)	when (Time of story)	Events	Macro events	Deixis and break types

Figure 11.0.1: Annotation schema

For the annotation the diegetic events create 4 tables for the participants (who component), the locations (where the component), the phrases enunciated by extradiegetic voices and a summary table as shown in ref fig: AnnotationSchema. The annotation process comprises the following steps:

1. Select an interval of narration, where it believes happening meaningful story events:

$$[T1\text{-}T2] \rightarrow Ex \text{ (or also } [T1\text{-}T2] \rightarrow [E1, E2, .., E2])$$

   where T1 and T2 are temporal chronological instants;

2. Choose the temporal diegetic indices of selected event Ex

$$\mathsf{Ex} \rightarrow [\mathsf{Td1}\text{-}\mathsf{Td2}](\mathsf{or\ also\ E1} \rightarrow [\mathsf{Td1}\text{-}\mathsf{Td2}], \mathsf{E2} \rightarrow [\mathsf{Td3}\text{-}\mathsf{Td4}], ..,);$$

3. Indicate the component "what" of the event Ex or with a verb or a nominal group corresponding to an event representing it. In the case that the component is an act of saying, insert it in the table of the sentences;
4. For each participant to the event (who component) choose a name through an epithet, and add it in the participant table;
5. For each "where" component the event choose an epithet and insert it in locations table;
6. For the name of an event, choose an epithet, which has to be inspired by "who" or "what" component of the event Ex;
7. For each event, annotate if has generated a break or a fitting (deixis) and indicate the type

Time of narration	who (participants list)	where (locations)	what (actions)	when (Time of story)		Events	Macro events	Deixis and break types
- 00:00:30	p1,p2		sit(p1,p2)	Td1	Td2	e11	Mev1	
- 00:02:38	p1,p2		talk(p1,p2)	Td3	Td4	e12		
- 00:02:40	p1,f1		say(p1,f1)	Td5	Td6	e13		
- 00:04:28	p1,c11		hold(p1,c11)	Td7	Td8	e14		
- 00:04:30	p1,f2		say(p1,f2)	Td9	Td10	e15		
- 00:04:37	p2,f3		say(p2,f3)	Td11	Td12	e16		
- 00:08:10	p3,p4	c21	talk(p3,p4)	Td13	Td14	e21	Mev2	ellipsis(e16,e21)
- 00:08:16	p3,p4		tell(p3,p4)	Td15	Td16	e22		
- 00:13:25	p3,p4		tell(p3,p4)	Td17	Td18	e24		
- 00:17:00	p3,c31		get(p3,c31)	Td19	Td20	e31		
- 00:18:46	p4,p6		interrogate(p4,p6)	Td21	Td22	e32		
- 00:19:35	p4,c32		play(p4,c32)	Td23	Td24	e33		
- 00:19:43	p3,p4,p6		shoot(p3,p4,p6)	Td25	Td26	e34		
- 00:20:50	p7,p8		meet(p7,p8)	Td27	Td28	e41	Mev3	ellipsis(e34,e41)
- 00:22:28	p7,p8		tell(p7,p8)	Td29	Td30	e42		
- 00:22:34	p8,p7		commitment(p8,p7,e45)	Td31	Td32	e44		
- 00:22:51	p4,c42		carry(p4,c42)	Td33	Td34	e46		
- 00:22:52	p3,c43,c44		wear(p3,c43,c44)	Td35	Td36	e47		
- 00:22:53	p4,c45,c46		wear(p4,c45,c46)	Td37	Td38	e48		
- 00:28:15	p3,c51,c52		buy(p3,c51,c52)	Td39	Td40	e51	Mev4	ellipsis(e48,e51)
- 00:29:14	p3,c53		drive(p3,c53)	Td41	Td42	e52		
- 00:29:53	p3,c61	c61	arrive(p3,c61)	Td43	Td44	e61		
- 00:31:32	p3,c62	c61	take(p3,c62)	Td45	Td46	e62		
- 00:31:57	p3,p5		goingDinner(p3,p5)	Td47	Td48	e63		
- 00:45:00	p3,p5	c63	talk(p3,p5)	Td49	Td50	e64		
- 00:47:34	p3,p5	c63	dance(p3,p5)	Td51	Td52	e71		
- 00:52:10	p5	c61	overdosed(p5)	Td53	Td54	e81		
- 00:54:43	p3,p5	c52	take(p3,p5)	Td55	Td56	e91		
- 00:57:58	p5,c91		save(c91,p5)	Td57	Td58	e92		
- 00:59:50	p3,p5,c92		tell(p3,p5,c92)	Td59	Td60	e93		
- 01:00:06	p3,p5		greet(p3,p5)	Td61	Td62	e94		
- 01:00:30	p81		watch(p81,TV)	Td63	Td64	e101	Mev5	ellipsis(e94,e101)
- 01:04:10	p10,p81,c101		tell(p10,p81,c101)	Td65	Td66	e102		
- 01:04:12	p10,p81,c102		give(p10,p81,c102)	Td67	Td68	e103		
- 01:04:51	p8,c103	c104	wakeUp(p8,c103)	Td69	Td70	e104	Mev6	deixis(101,104) --
- 01:05:20	c105,p8		report(c105,e106)	Td71	Td72	e105		flashforward(e103,e104)
- 01:09:40	p8,c106		catch(p8,c106)	Td73	Td74	e107		
- 01:10:42	p8		prepareToLeave(p8,c127)	Td75	Td76	e108		
- 01:19:39	p8,p11		reach(p8,p11)	Td77	Td78	e111		
- 01:20:30	p8,c102	c121	lookFor(p8,c102)	Td79	Td80	e121		
- 01:21:19	p8,p11		getAngry(p8,p11)	Td81	Td82	e122		
- 01:26:03	p8	c122	go(p8,c122)	Td83	Td84	e123		
- 01:26:21	p8,c123	c124	see(p8,c123)	Td85	Td86	e124		
- 01:26:32	p8,c125	c126	hear(p8,c125)	Td87	Td88	e125		
- 01:26:41	p3,p8		shoot(p8,p3)	Td89	Td90	e131		
- 01:27:10	p3		die(p3)	Td91	Td92	e132		
- 01:29:33	p7,p8		meet(p7,p8)	Td93	Td94	e141		
- 01:31:20	p7,p8		tryToKill(p7,p8)	Td95	Td96	e142		
- 01:33:28	p7,p8	c141	seize(p7,p8,p12)	Td97	Td98	e143		
- 01:36:59	p7,p13		chooseVictim(p13,p7)	Td99	Td100	e151		
- 01:38:04	p8	c141	wriggleAway(p8,c141)	Td101	Td102	e161		
- 01:39:11	p7,p8		rescue(p8,p7)	Td103	Td104	e162		
- 01:40:51	p7,p8,p13,p12		save(p8,p7)	Td105	Td106	e163		
- 01:42:19	p7,p8		declareTruce(p7,p8)	Td107	Td108	e164		
- 01:43:03	p7,p8		takeCommitment(p8,p7,e166)	Td109	Td110	e165		
- 01:45:52	p8,p11		pickUp(p8,p11)	Td111	Td112	e167		
- 01:46:08	p14	c171	listen(p14,c171)	Td113	Td114	e171	Mev7	ellipsis(e167,e171)
- 01:46:51	p4,c172		play(p4,c172)	Td115	Td116	e172		
- 01:46:56	p3,p4,p6		shoot(p3,p4,p6)	Td117	Td118	e173		
- 01:47:15	p14	c173	comeOut(p4,c173)	Td119	Td120	e174		
- 01:47:18	p3,p4,p14,c174		shoot(p3,c174,p3,p4)	Td121	Td122	e175		
- 01:47:29	p3,p4,c175		goThrough(c175,pe,p4)	Td123	Td124	e176		
- 01:47:34	p3,p4		answerToFire(p3,p4)	Td125	Td126	e177		
- 01:47:38	p3,p4,p14		kill(p3,p4,p14)	Td127	Td128	e178		
- 01:48:58	p3,p4,p15		takeAway(p3,p4,p15)	Td129	Td130	e179		
- 01:50:35	p3,p14		kill(p3,p14)	Td131	Td132	e181		
- 01:51:00	p4,p16		call(p4,p16)	Td133	Td134	e182		
- 01:52:20	p3,p4	c191	washHands(p3,p4)	Td135	Td136	e191		
- 01:54:00	p3,p4,p16	c192	argue(p3,p4,p16)	Td137	Td138	e192		
- 01:54:31	p3,p4,p16		say(p16,p3,p4,e194)	Td139	Td140	e193		
- 01:55:19	p4,p7		call(p4,p7)	Td141	Td142	e201		
- 01:55:40	p4,p7		say(p7,p4,e203)	Td143	Td144	e202		
- 01:56:17	p18		receiveInformation(p18)	Td145	Td146	e204		
- 01:56:46	p18	c193	arrive(p18,c193)	Td147	Td148	e211		
- 02:02:58	p3,p4,c21		clean(p3,p4,c21)	Td149	Td150	e212		
- 02:04:46	p3,p4		changeClothes(p3,p4)	Td151	Td152	e213		
- 02:06:13	p3,c211,c212		wear(p3,c211,c212)	Td153	Td154	e214		
- 02:06:14	p4,c213,c214		wear(p4,c213,c214)	Td155	Td156	e215		
- 02:07:29	p3,p4,p15,p18,c21	c215	take(p3,p4,p15,p18,c21)	Td157	Td158	e216		
- 02:10:58	p3,p4		haveBreakfast(p3,p4)	Td159	Td160	e221		
- 02:11:02	p1,f4		say(p1,f4)	Td161	Td162	e222		deixis(e222,e13)
- 02:11:57	p1,c231		hold(p1,c231)	Td163	Td164	e231		
- 02:11:59	p1,f5		say(p1,f5)	Td165	Td166	e232		
- 02:12:07	p1,f6		say(p1,f6)	Td167	Td168	e233		
- 02:16:32	p1,p4,c231		threate(p4,p1,c231)	Td169	Td170	e234		
- 02:20:33	p1,p2,p4		forceToSurrender(p4,p1,p2)	Td171	Td172	e235		
- 02:21:19	p4,c32		play(p4,c32)	Td173	Td174	e236		
- 02:22:38	p1,p4,p2		inviteToLeave(p4,p1,p2,Bar)	Td175	Td176	e237		
- 02:23:27	p3,p4		comeOut(p3,p4,c32,Bar)	Td177	Td178	e241		
- 02:23:28	p3,c211,c212		wear(p3,c211,c212)	Td179	Td180	e242		
- 02:23:29	p4,c213,c214		wear(p4,c213,c214)	Td181	Td182	e243		

Figure 11.0.2: Diegetic event table of *Pulp Fiction*

Participants (characters)	
ID	Epithet
p1	young man
p2	young woman
p3	Vincent
p4	Jules
p5	Mia
p6	Brett
p7	Wallace
p8	Butch
p9	drug dealer
p10	captain Koons
p11	Fabienne
p81	Butch child
p12	Maynard
p13	Zed
p14	young man
p15	Marvin
p16	Jimmie
p17	Bonnie
p18	Wolf

Participants (objects)	
ID	Epithet
c11	gun
c21	car
c22	Netherlands
c31	briefcase
c32	verse from Ezekiel 25:17
c41	boxing match
c42	briefcase
c43	white t-shirt
c44	light blue shorts
c45	light blue t-shirt
c46	red shorts
c51	drug
c52	p9's house
c53	auto
c61	p5's house
c62	drink
c63	restaurant
c91	syringe
c92	joke of the tomato
c101	story of c102
c102	watch
c103	couch in c104
c104	dressing room
c105	radio
c106	taxi
c121	bag
c122	p8's home
c123	machine gun
c124	kitchen
c125	water
c126	bathroom
c127	Country
c141	store
c171	hotel room
c172	verse from Ezekiel 25:17
c173	bathroom
c174	loader
c175	bullets
c191	p16's bathroom
c192	p16's kitchen
c193	p16's house
c211	white t-shirt
c212	light blue shorts
c213	light blue t-shirt
c214	red shorts
c215	junkyard "Monster Joe"
c231	gun

Sentences	
ID	Transcription
f1	garcon, coffee
f2	Nobody move, this is a robbery
f3	and if by chance any of you assholes dares to move, I'll kill you, ugly motherfuckers, every last
f4	garcon, coffee
f5	Nobody move, this is a robbery
f6	and if by chance any of you dares to move, I will do all dried up last, ugly son of a bitch, do you understand?

Evoked/Announced Events	
ID	Description
e23	c22 trip of di p3 - evoked in e22
e25	dinner with p5 - announced in e63
e43	boxing match that p8 will fight - evoked in e106
e45	p8 losing c41 - announced in e44
e106	boxing match - evoked in e105
e166	leave the country - announced in e165
e194	p17 will return c193 at 9.30 - announced in e193
e203	p18 will come in handy - announced in e202

Figure 11.0.3: Participants, Sentences and Evoked/Announced events tables of *Pulp Fiction*

Time of narration	who (participants list)	where (locations)	what (actions)	when (Time of story)		Events	Macro events	Deixis and break types
-- 00:03:28	p1,p2	c11	fly(p1,p2,c11)	Td1	Td2	e11	Mev1	
-- 00:04:03	p12,c11		shot(p12,c11)	Td3	Td4	e12		
-- 00:05:00	p3,p13	c21	assist(p3,p13)	Td5	Td6	e21	Mev2	ellipsis(e21,e12)
-- 00:06:02	p1,p14		succor(p14,p1)	Td7	Td8	e31	Mev3	deixis(e31,e12)
-- 00:07:35	p3,p15		tell(p15,p3,e411)	Td9	Td10	e41	Mev4	deixis(e41,e21)
-- 00:08:40	p1,p14		takeCare(p14,p1)	Td11	Td12	e51	Mev5	deixis(e51,e31)
--	p1,p16		interrogate(p16,p1)	Td13	Td14	e61	Mrv6	deixis(e61,e51)
-- 00:10:15	p1,p3,c61		give(p3,p1,c61)	Td15	Td16	e62		
--	p1,p3	c71	travel(p1,p3,c71)	Td17	Td18	e71	Mev7	deixis(e71,e62)
--	p3,p4,c72		lend(p3,p4,c72)	Td19	Td20	e72		
-- 00:11:57	p4		die(p4)	Td21	Td22	e73		
--	p1,p3	c81	stay(p3,p1,c81)	Td23	Td24	e81	Mev8	deixis(e81,e73)
--	p1,p3	c81	establish(p3,p1,c81)	Td25	Td26	e82		
--	p3,p17		greet(p3,p17)	Td27	Td28	e83		
--	p1,p3,c82		askToRead(p1,p3,c82)	Td29	Td30	e84		
--	p1,p3,c82		give(p1,p3,c82)	Td31	Td32	e85		
-- 00:20:10	p1		sleep(p1)	Td33	Td34	e86		
--	p5, p18	c93	talk(p5, p18)	Td35	Td36	e91	Mev9	ellipsis(e91,e86)
--	p5,c94	c91	draw(p5,c94)	Td37	Td38	e92		
--	p2,p6,c92	c93	arrive(p6,p2,c92,c93)	Td39	Td40	e93		
-- 00:22:28	p5,p6,p7		say(p5,p6,p7,f1)	Td41	Td42	e94		
-- 00:24:10	p3		wakeUp(p3)	Td43	Td44	e101	Mev10	deixis(e101,e86)
--	p1,p3,c101		show(p1,p3,c101)	Td45	Td46	e102		
-- 00:25:37	p1		sleep(p1)	Td47	Td48	e103		
-- 00:26:19	p5,p6,p7	c93	celebrate(p5,p6,p7)	Td49	Td50	e111	Mev11	ellipsis(e111,e94)
-- 00:26:39	p1,p3,c82		read(p3,p1,c82)	Td51	Td52	e121	Mev12	deixis(e121,e103)
-- 00:28:20	p5,p6,p7,p8		recount(p7,p5,p6,p8)	Td53	Td54	e131	Mev13	ellipsis(e131,e111)
-- 00:28:40	p3,c82		lay(p3,c82)	Td55	Td56	e141	Mev14	deixis(e141,e121)
--	p1		sleep(p1)	Td57	Td58	e142		
--	p3,p9		meet(p9,p3)	Td59	Td60	e143		
--	p3,p9		askHospitality(p9,p3)	Td61	Td62	e144		
--	p1,p3,c141		brings(p3,p1,c141)	Td63	Td64	e145		
--	p1,p3		say(p3,p1,e143)	Td65	Td66	e146		
--	p1,p9		talk(p1,p9)	Td67	Td68	e147		
-- 00:33:39	p1,p5,p9		say(p9,p1,p5)	Td69	Td70	e148		deixis(e148,e94)
-- 00:37:31	p5,p6,p7	c151	meet(p5,p6,p7)	Td71	Td72	e151	Mev15	flashback(e148,e151)
--	p1,p3		wakeUp(p3,p1)	Td73	Td74	e161	Mev16	flashforward(e161,e151)
--	p1,p3,p9		talk(p3,p9,p1)	Td75	Td76	e162		
-- 00:40:14	p3,p9		say(p9,p3,e1631)	Td77	Td78	e163		
-- 00:42:05	p6	c93	leave(p6,c93)	Td79	Td80	e171	Mev17	flashback(e163,e171)
--	p3,p10		save(p10,p3)	Td81	Td82	e181	Mev18	flashforward(e181,e171)
-- 00:46:18	p19	c81	camp(p19,c81)	Td83	Td84	e182		
--	p5,c94		see(p5,c94)	Td85	Td86	e191	Mev19	flashback(e181,e191)
--	p5,c192		find(p5,c192)	Td87	Td88	e192		
--	p5,p7	c191	accident(p5,p7)	Td89	Td90	e193		
--	p5,p7	c191	waitingReliefEfforts(p5,p7)	Td91	Td92	e194		
--	p7,c193,c91		put(p7,c193,c91)	Td93	Td94	e195		
-- 01:05:02	p5,p6,p7		say(p7,p5,p6)	Td95	Td96	e196		
-- 01:07:13	p1,p10		leave(p1,p10)	Td97	Td98	e201	Mev20	flashforward(e201,e196)
-- 01:13:03	p6,p5,p7		betray(p7,p6,p5)	Td99	Td100	e211	Mev21	flashback(e201,e211)
--	p3,c221		find(p3,c221)	Td101	Td102	e221	Mev22	flashforward(e221,e211)
--	p1,p3,c221		talk(p1,p3,c221)	Td103	Td104	e222		
-- 01:14:12	p5,p7		lunch(p5,p7)	Td105	Td106	e231	Mev23	flashback(e222,e231)
-- 01:20:03	p6,p7		return(p6,p7)	Td107	Td108	e232		
-- 01:21:06	p1,p9		talk(p1,p9)	Td109	Td110	e241	Mev24	flashforward(e241,e233)
--	p6,p7		follow(p6,p7)	Td111	Td112	e251	Mev25	flashback(e241,e251)
--	p5,p7		arrive(p7,p5)	Td113	Td114	e252		
-- 01:27:43	p5,p7,c251		give(p5,p7,c251)	Td115	Td116	e253		
--	p3,p10		lead(p3,p10)	Td117	Td118	e261	Mev26	flashforward(e261,e253)
-- 01:30:40	p1,p9, c261		ask(p1,p9, c261)	Td119	Td120	e262		
--	p9		comeToKnow(p9,e2711)	Td121	Td122	e271	Mev27	flashback(e262,e271)
--	p9,p20		capture(p20, p9)	Td123	Td124	e272		
-- 01:36:16	p20,c261		cut(p20,c261)	Td125	Td126	e273		
-- 01:36:37	p1,p9,c261		show(p9,p1,c261)	Td127	Td128	e281	Mev28	flashforward(e281,e273)
--	p5,p9		say(p9,p5,e2911)	Td129	Td130	e291	Mev29	flashback(e281,e291)
-- 01:40:23	p5,p7		meet(p5,p7)	Td131	Td132	e292		
-- 01:40:43	p1,p9		sleep(p1,p9)	Td133	Td134	e301	Mev30	flashforward(e301,e292)
-- 01:44:20	p5,p6,p7,p10,p11		haveDinner(p5,p6,p7,p10,p11)	Td135	Td136	e311	Mev31	flashback(e301,e311)
--	p1,p3		letSleep(p3,p1)	Td137	Td138	e321	Mev32	flashforward(e321,e311)
--	p21	c321	arrive(p21, c321)	Td139	Td140	e322		
--	p1,p3,p9,p10		celebrate(p1,p3,p9,p10,e2911)	Td141	Td142	e323		
-- 02:00:48	p1,p9		say(p9,p1,e3241)	Td143	Td144	e324		
-- 02:02:34	p5,p11		biddingFarewell(p11,p5)	Td145	Td146	e331	Mev33	flashback(e324,e331)
-- 02:03:22	p1,p6,p7,p9		seekClarification(p9,p1,p6,p7)	Td147	Td148	e341	Mev34	flashforward(e341,e331)
--	p5,p6		tryToKill(p6,p5)	Td149	Td150	e351	Mev35	flashback(e341,e351)
--	p6		die(p6)	Td151	Td152	e352		
--	p5,p7		help(p5,p7)	Td153	Td154	e353		
--	p5,p7	c351	leave(p5,p7)	Td155	Td156	e354		
--	p5		arrested(p5)	Td157	Td158	e355		
-- 02:16:05	p5		escape(p5)	Td159	Td160	e356		
-- 02:16:43	p1,p9		say(p1,p9,e3611)	Td161	Td162	e361	Mev36	flashforward(e361,e365)
--	p5,p20		barter(p5,p20)	Td163	Td164	e371	Mev37	flashback(e361,e371)
-- 02:17:26	p5,p20	c371	go(p5,p20)	Td165	Td166	e372		
-- 02:19:57	p10		prepareToLeave(p10)	Td167	Td168	e381	Mev38	flashforward(e381,e372)
-- 02:20:59	p5,p7	c351	find(p5,p7)	Td169	Td170	e391	Mev39	flashback(e381,e391)
--	p10		goAway(p10)	Td171	Td172	e401	Mev40	flashforward(e401,e391)
-- 02:28:01	p1,p3,c401		ask(p1,p3,c401)	Td173	Td174	e402		
-- 02:29:10	p3,p9	c81	leave(p3,p9)	Td175	Td176	e411	Mev41	deixis(e411,e402)
-- 02:29:40	p5,p7	c371	takeAway(p5,p7)	Td177	Td178	e421	Mev42	flashback(e411,e421)
-- 02:30:02	p3,p9	c81	turnAway(p3,p9)	Td179	Td180	e431	Mev43	flashforward(e431,e421)

Figure 11.0.4: Diegetic event table of *The English Patient*

Participants (characters)	
ID	Epithet
p1	László Almásy
p2	woman in airplane
p3	Hana
p4	friend of p3
p5	p1 before the accident
p6	Geoffrey Clifton
p7	Katharine Clifton
p8	Candaule
p9	David Caravaggio
p10	Kip Singh
p11	Madox
p12	soldiers
p13	wounded soldiers
p14	bedouins
p15	soldier
p16	Italian soldier
p17	fellow soldiers
p18	Bedouin
p19	canadian military
p20	german soldiers
p21	US soldiers

Participants (objects)	
ID	Epithet
c11	airplane
c21	train
c81	abandoned convent
c82	book of p1
c91	book of p5
c92	airplane of p2
c221	Christmas card
c251	thimble
c371	airplane
c71	military truck
c93	desert village
c151	bar
c191	desert
c321	country
c351	desert cave
c61	drink
c72	money
c94	mountain
c101	landscape
c141	food
c192	rock engravings
c193	drawing
c261	p9's hands
c401	dose of morphine

Sentences	
ID	Transcription
f1	my name is László Almásy

Evoked/Announced Events	
ID	Description
e411	p3's husband dies - evoked in e41
e1631	p1 injures p9 - evoked in e163
e2711	p5 betrays p11 - evoked in e271
e2911	the war ends - evoked in e291
e3241	p11 shoots himself because e2711 - evoked in e324
e3611	p7 dies - evoked in e361

Figure 11.0.5: Participants, Sentences and Evoked/Announced events tables of *The English Patient*

Time of narration	who (participants list)	where (locations)	what (actions)	when (Time of story)		Events	Macro events	Deixis and break types
--	p1,c1		take(p1,c1)	Td1	Td2	e11	Mev1	
-- 00:02:27	p1,p2		kill(p1,p2)	Td3	Td4	e12		
-- 00:02:50	p1	c2	wakeUp(p1)	Td5	Td6	e21	Mev2	ellipsis(e21,e12)
-- 00:02:58	p1,p3		say(p1,p3,e3111)	Td7	Td8	e31	Mev3	ellipsis(e31,e21)
--	p1,p2	c4	goTo(p1,p2,c4)	Td9	Td10	e32		
-- 00:06:07	p1,p2		shoot(p1,p2)	Td11	Td12	e33		deixis(e33,e12)
-- 00:06:44	p1,c5	c2	hasAttached(p1,c5)	Td13	Td14	e41	Mev4	deixis(e41,e21)
--	p1,p3		askNoCalls(p1,p3)	Td15	Td16	e51	Mev5	ellipsis(e51,e41)
-- 00:09:47	p1,p2,p3	c3	say(p3,p1,e521)	Td17	Td18	e52		deixis(e52,e31)
-- 00:09:52	p1,c5		remove(p1,c5)	Td19	Td20	e61	Mev6	ellipsis(e61,e41)
-- 00:10:38	p1		takeCall(p1)	Td21	Td22	e62		deixis(e62,e41)
-- 00:11:28	p1,p8,c6,c7		give(p8,p1,c6,c7)	Td23	Td24	e71	Mev7	ellipsis(e71,e62)
--	p1	c8	goOut(p1,,c8)	Td25	Td26	e72		
--	p1	c3	go(p1,c3)	Td27	Td28	e73		
--	p1,c7		open(p1,c7)	Td29	Td30	e74		
-- 00:15:32	p1,p2,c13		say(p2,p1,c13,e751)	Td31	Td32	e75		deixis(e75,e52)
-- 00:15:36	p1,c13		say(p1,c13,f1)	Td33	Td34	e81	Mev8	ellipsis(e81,e62)
-- 00:16:15	p1,c9,c13		tell(p1,c13,c9)	Td35	Td36	e82		deixis(e82,e62)
-- 00:16:58	p1,p4	c10	meet(p1,p4)	Td37	Td38	e91	Mev9	ellipsis(e91,e82)
--	p1,p4		talk(p1,p4)	Td39	Td40	e92		
--	p1,p4,c7		deliver(p4,c7,p1)	Td41	Td42	e93		
--	p1,p4,c6		deliver(p4,p1,c6)	Td43	Td44	e94		
-- 00:21:22	p1	c6	go(p1,c36)	Td45	Td46	e95		deixis(e95,e71)
-- 00:21:55	p1,c13		tell(p1,c13,e1011)	Td47	Td48	e101	Mev10	ellipsis(e101,e82)
-- 00:21:59	p1,c11		open(p1,c11)	Td49	Td50	e102		deixis(e102,e82)
-- 00:22:18	p1,p2		meet(p1,p2)	Td51	Td52	e111	Mev11	ellipsis(e111,e102)
--	p1	c3	go(p1,c3)	Td53	Td54	e112		
--	p1,p3		say(p3,p1,e1131)	Td55	Td56	e113		
--	p1,p4	c10	go(p1,p4,c10)	Td57	Td58	e114		
-- 00:23:59	p1,p4	c10	meet(p1,p4,c10)	Td59	Td60	e115		deixis(e115,e91)
-- 00:25:45	p1		shave(p1)	Td61	Td62	e121	Mev12	ellipsis(e121,e102)
-- 00:27:20	p1,c13		say(p1,c13,e1221)	Td63	Td64	e122		deixis(e121,e102)
-- 00:28:00	p1,p4		wakeUp(p1,p4)	Td65	Td66	e131	Mev13	ellipsis(e131,e122)
--	p1,p4		takeAppointment(p4,p1)	Td67	Td68	e132		
-- 00:30:25	p1,p2		meet(p1,p2)	Td69	Td70	e133		deixis(e133,e111)
-- 00:31:15	p1,c13		tell(p1,c13,e1411)	Td71	Td72	e141	Mev14	deixis(e141,e122)
-- 00:31:40	p1	c14	go(p1,c14)	Td73	Td74	e151	Mev15	ellipsis(e151,e141)
--	p1,p4		talk(p1,p4)	Td75	Td76	e152		
-- 00:37:49	p1,p4		sleep(p1,p4)	Td77	Td78	e153		deixis(e153,e131)
-- 00:38:35	p1,c13		recount(p1,c13,e1611)	Td79	Td80	e161	Mev16	deixis(e161,e141)
-- 00:39:20	p1	c3	wakeUp(p1)	Td81	Td82	e171	Mev17	ellipsis(e171,e161)
--	p1,p2		come(p2,p1)	Td83	Td84	e172		
--	p1,p2		askForHelp(p2,p1)	Td85	Td86	e173		
--	p1,p2,c37		show(p1,p2, c37)	Td87	Td88	e174		
--	p1,p2,p6		carryAway(p1,p2,p6)	Td89	Td90	e175		
-- 00:43:12	p1	c14	go(p1,c14)	Td91	Td92	e176		deixis(e176,e151)
-- 00:43:22	p1,c13		recount(p1,c13,e1811)	Td93	Td94	e181	Mev18	ellipsis(e181,e161)
-- 00:44:10	p1,c13		recount(p1,c13,e1811)	Td95	Td96	e182		deixis(e181,e161)
-- 00:44:20	p1,c16	c15	beIn(p1,c16,c15)	Td97	Td98	e191	Mev19	ellipsis(e191,e182)
--	p1		takeShower(p1)	Td99	Td100	e192		
--	p1,p6		abduct(p1,p6)	Td101	Td102	e193		
--	p1,c17		leaveMessage(p1,c17)	Td103	Td104	e194		
-- 00:46:55	p1		sleep(p1)	Td105	Td106	e195		deixis(e195,e171)
-- 00:47:10	p1		hangUp(p1,c13)	Td107	Td108	e201	Mev20	ellipsis(e201,e182)
-- 00:47:23	p1,c18,c19		warm(p1,c19,c18)	Td109	Td110	e202		deixis(e202,e182)
-- 00:47:59	p1,p6		escape(p1,p6)	Td111	Td112	e211	Mev21	ellipsis(e211,e202)
--	p1	c20	go(p1,c20)	Td113	Td114	e212		
--	p1,c16		take(p1,c16)	Td115	Td116	e213		
-- 00:49:58	p1,c16	c15	beIn(p1,c16,c15)	Td117	Td118	e214		deixis(e214,e191)
-- 00:50:03	p1,c18		mayDip(p1,c18)	Td119	Td120	e221	Mev22	ellipsis(e221,e202)
-- 00:50:11	p1,c21		take(p1,c21)	Td121	Td122	e222		deixis(e222,e202)
-- 00:50:28	p1		extinguishFire(p1)	Td123	Td124	e231	Mev23	ellipsis(e231,e222)
--	p1,p6		chase(p6,p1)	Td125	Td126	e232		
-- 00:51:23	p1,p6		escape(p1,p6)	Td127	Td128	e233		deixis(e233,e211)
-- 00:51:30	p1,c21		lay(p1,c21)	Td129	Td130	e241	Mev24	ellipsis(e241,e222)
-- 00:51:34	p1,c13		answer(p1,c13)	Td131	Td132	e242		deixis(e242,e222)
-- 00:54:05	p1,c22		setFire(p1,c22)	Td133	Td134	e251	Mev25	ellipsis(e251,e242)
-- 00:54:19	p1		extinguishFire(p1)	Td135	Td136	e252		deixis(e252,e231)
--	p1,c13		talk(p1,c13,c23)	Td137	Td138	e261	Mev26	ellipsis(e261,e252)
-- 00:55:08	p1		getTattoo(p1,f2)	Td139	Td140	e262		deixis(e262,e242)
-- 00:55:45	p1		wakeUp(p1)	Td141	Td142	e271	Mev27	ellipsis(e271,e262)
--	p1,c22		see(p1,c22)	Td143	Td144	e272		
-- 00:57:05	p1,p9	c24	see(p1,p9,c24)	Td145	Td146	e273		deixis(e272,e251)
--	p1		beInformed(p1,e2811)	Td147	Td148	e281	Mev28	ellipsis(e281,e273)
-- 00:57:43	p1,c21		write(p1,c21,f3)	Td149	Td150	e282		deixis(e282,e262)
-- 00:57:59	p1	c3	arrive(p1,c3)	Td151	Td152	e291	Mev29	ellipsis(e291,e282)
--	p1,c25		call(p1,c25)	Td153	Td154	e292		
--	p1,p9		come(p9,p1)	Td155	Td156	e293		
--	p1,p9	c24	askToGo(p1,p9,c24)	Td157	Td158	e294		
-- 01:00:07	p1		sleep(p1)	Td159	Td160	e295		deixis(e295,e271)
--	p1,c13		say(p1,c13,e3011)	Td161	Td162	e301	Mev30	ellipsis(e301,e295)
-- 01:02:17	p1,c26		complete(p1,c26)	Td163	Td164	e302		deixis(e302,e282)
-- 01:02:30	p1,p2	c27	talk(p1,c27,p2)	Td165	Td166	e311	Mev31	ellipsis(e311,e302)
--	p1,p2,c3		inform(p2,p1,c3)	Td167	Td168	e312		
-- 01:06:32	p1	c3	arrive(p1,c3)	Td169	Td170	e313		deixis(e313,e291)
--	p1,c28		read(p1,c28)	Td171	Td172	e321	Mev32	ellipsis(e321,e313)
-- 01:07:05	p1,c13		hangUp(p1,c13)	Td173	Td174	e322		deixis(e322,e302)
-- 01:07:24	p4	c14	go(p4,c14)	Td175	Td176	e331	Mev33	ellipsis(e331,e322)
--	p1,p4		say(p4,p1,e3321)	Td177	Td178	e332		
--	p1,p6		leave(p1,p6)	Td179	Td180	e333		
-- 01:10:00	p1,p2	c27	talk(p1,p2)	Td181	Td182	e334		deixis(e334,e311)
-- 01:10:24	p1,p3,c13		askNoCall(p1,c13,p3)	Td183	Td184	e341	Mev34	deixis(e341,e322)
-- 01:10:37	p4	c14	comeBack(p4,c14)	Td185	Td186	e351	Mev35	ellipsis(e351,e341)
--	p1,p4		bicker(p1,p4)	Td187	Td188	e352		
--	p1,p4		punche(p1,p4)	Td189	Td190	e353		
--	p4	c14	leave(p4,c14)	Td191	Td192	e354		
-- 01:14:08	p4	c14	go(p4,c14)	Td193	Td194	e355		deixis(e355,e331)
-- 01:14:29	p1,p6		phone(p6,p1)	Td195	Td196	e361	Mev36	ellipsis(e361,e341)
-- 01:14:41	p1,p6		tell(p6,p1,e3621)	Td197	Td198	e362		deixis(e362,e341)
-- 01:17:40	p1,p4		beHospitable(p4,p1)	Td199	Td200	e371	Mev37	ellipsis(e371,e362)
--	p4	c14	leave(p4,c14)	Td201	Td202	e372		
-- 01:18:23	p4	c14	comeBack(p4,c14)	Td203	Td204	e373		deixis(e373,e351)
--	p1,c29,c30		receive(p1,c29,c30)	Td205	Td206	e381	Mev38	ellipsis(e381,e373)
-- 01:19:07	p1,c13		look(p1,c13)	Td207	Td208	e382		deixis(e382,e362)
-- 01:19:52	p1,p4	c10	drink(p1,p4)	Td209	Td210	e391	Mev39	ellipsis(e391,e382)
-- 01:19:54	p1,c13		answer(p1,c13)	Td211	Td212	e401	Mev40	ellipsis(e401,e382)
-- 01:19:57	p1,c30		maintain(p1,c30)	Td213	Td214	e402		
-- 01:20:15	p1,p5,c13		tell(p1,c13,p5)	Td215	Td216	e403		deixis(e403,e382)
-- 01:20:23	p1,p4	c10	go(p1,p4,c10)	Td217	Td218	e411	Mev41	ellipsis(411,e403)
-- 01:21:50	p1,p4		notKnow(p4,p1)	Td219	Td220	e412		
-- 01:23:01	p1,p4	c10	drink(p1,p4,)	Td221	Td222	e413		deixis(e413,e391)
-- 01:23:09	p1,c30		putDown(p1,c30)	Td223	Td224	e421	Mev42	ellipsis(e421,e402)
-- 01:26:27	p1,c13		tell(p1,e4221)	Td225	Td226	e422		deixis(e422,e402)
-- 01:26:35	p1,c27	c31	arrive(p1,c27,c31)	Td227	Td228	e431	Mev43	ellipsis(e431,e422)
--	p1,c34		getTattoo(p1,c34)	Td229	Td230	e432		
--	p1,c32		find(p1,c32)	Td231	Td232	e433		
-- 01:30:08	p1,p4	c10	go(p1,p4,c10)	Td233	Td234	e434		deixis(e434,e411)
--	p1,p10,c13		talk(p1,c13,p10)	Td235	Td236	e441	Mev44	ellipsis(e441,e434)
--	p1	c12	leave(p1,c12)	Td237	Td238	e442		
--	p1,p2		meet(p1,p2)	Td239	Td240	e443		
--	p1	c4	go(p1,c4)	Td241	Td242	e444		
-- 01:35:42	p1,p10		kill(p1,p10)	Td243	Td244	e445		
--	p1,c33		wear(p1,c33)	Td245	Td246	e446		
--	p1,p2		come(p2,p1)	Td247	Td248	e447		
--	p1,p2,c30		give(p2,p1,c30)	Td249	Td250	e448		
--	p1,c30		burn(p1,c30)	Td251	Td252	e449		
--	p1,c34		write(p1,c34)	Td253	Td254	e4410		
--	p1,c35		take(p1,c35)	Td255	Td256	e4411		
-- 01:45:53	p1,c35	c31	arrive(p1,c35,c31)	Td257	Td258	e4412		deixis(e4412,e431)

Figure 11.0.6: Diegetic event table of *Memento*

Participants (characters)	
ID	Epithet
p1	Leonard Shelby
p2	Teddy Gammell
p3	Burt Hadley
p4	Natalie
p5	Sammy Jankis
p6	Dodd
p7	Miss Jankis
p8	waiter
p9	the blonde girl
p10	drug dealer

Participants (objects)	
ID	Epithet
c1	picture of p2 cadaver
c2	hotel room
c3	the hotel
c4	abandoned shack
c5	sheet that says "Shave"
c6	keys
c7	package
c8	restaurant
c9	disorder of p1
c10	nightclub
c11	razor blade
c12	hotel room 21
c13	phone
c14	p4's house
c15	bathroom
c16	bottle
c17	p2's voice mail
c18	needle
c19	lighter
c20	p6's hotel room
c21	paper that says f2
c22	some objects of p1 wife
c23	drug
c24	bathroom of c2
c25	escort service
c26	the tattoo with utterance f1, f2
c27	car
c28	the tattoo with utterance f4
c29	letter that says f5
c30	picture of p1
c31	tattoo parlor
c32	broken picture
c33	clothes of p10
c34	p2's car license number
c35	p10's car
c36	bathroom of c10
c37	p6's gagged

Sentences	
ID	Transcription
f1	who is?
f2	Fact 5
f3	drug dealer
f4	Never answer the phone
f5	Take my call

Evoked/Announced Events	
ID	Description
e521	p2 arrived at c3 - announced in e52
e751	p2 would arrive shortly - announced in e75
e1011	p1's work at the insurance company - evoked in e101
e1131	a week earlier p1 was in c12 - evoked in e113
e1221	p1 had ordered medical examinations to p5 - evoked in e122
e1411	p5 makes conditioning tests - evoked in e141
e1611	p5 takes the decision, due to the conditioning test, to reject the compensation to p5 - evoked in e161
e1811	p7 rejects of the insurance company's decision - evoked in e181
e2811	a drug dealer kills p1 wife - evoked in e281
e3011	p1 told p7 that he believed that p5 was able to assimilate new memories - evoked in e301
e3111	p2 arrived at c3 - announced in e311
e3321	p6 defeats p4 - announced in e332
e3621	a policeman phoned p6 - announced in e326
e4221	p5 killed p7 with insulin - announced in e422

Figure 11.0.7: Participants, Sentences and Evoked/Announced events tables of *Memento*

12 COMPUTATIONAL ASPECTS

In the sections of this appendix I present some formalizations that underlie the formal apparatus used in this book.

12.1 VISUAL ACTS FORMALIZATION

In the construction of my cognitive models we have assumed that the viewer activates perceptual-cognitive acts (Visual Acts) in correspondence with words, sounds and images present in the story of the film. It is clear that my mechanism of specialization stops itself at the visual act primitives and does not active further refinements. In this way, I inserted conditions of the type visActWt ([T1, T2], Spx, Segx, Actx, Ex) we did not make any hypothesis as to how the symbols T1, T2, Spx, Segx, Actx, Ex were generated " in the cognitive space of the spectator ". The hypothesis that we formulate that exist symbols for each visual act operation. Obviously, in a film annotation process, the uniqueness of the symbols must be guaranteed. Thus in the Visual Act previously cited t1, t2, seg1, .., ect are all distinct symbols. An example of definitions:

$$
\begin{array}{l}
visActWt([t1,t2], spx, seg1, act1, e1).\\
time(t1).time(t2).spectator(spx).filmcSegment(seg1).\\
diegeticAction(act1).diegeticEvent(e1).\\
-\\
visActWt([t3,t4], spx, seg2, act2, e2).\\
time(t3).time(t4).filmcSegment(seg2).\\
diegeticAction(act2).diegeticEvent(e2).\\
\ldots\\
visActWt([tm,tn], spx, segs, actn, en).\\
time(tm).time(tm).filmcSegment(segn).\\
diegeticAction(actn).diegeticEvent(en).
\end{array}
\tag{12.1.1}
$$

Uniqueness is a requirement that also holds for the symbol definitions of macro events and courses of events.

% eqn:inVisActxWhat

$$\begin{aligned}
&mev(T2, addBel(bel(Spx, what(Ex, Actx)))) \leftarrow \\
&\ time(T2), \\
&\ spectator(Spx), \\
&\ visActWt([T1, T2], Spx, Segx, Actx, Ex), \\
&\ hasIntTime(Segx, [T1, T2]), \\
&\ diegeticAction(Actx), \\
&\ diegeticEvent(Ex).
\end{aligned} \tag{12.1.2}$$

% eqn:inVisActxWhen

$$\begin{aligned}
&mev(T2, addBel(bel(Spx, when(Ex, on([Td1, Td2]))))) \leftarrow \\
&\ time(T2), \\
&\ spectator(Spx), \\
&\ visActWn([T1, T2], Spx, Segx, [Td1, Td2], Ex), \\
&\ diegeticInt([Td1, Td2]), \\
&\ hasIntTime(Segx, [T1, T2]), \\
&\ diegeticEvent(Ex).
\end{aligned} \tag{12.1.3}$$

% eqn:inVisActxWhere

$$\begin{aligned}
&mev(T2, addBel(bel(Spx, where(Ex, Wrx)))) \leftarrow \\
&\ time(T2), \\
&\ spectator(Spx), \\
&\ visActWr([T1, T2], Spx, Segx, Wrx, Ex), \\
&\ hasIntTime(Segx, [T1, T2]), \\
&\ diegeticSpace(Wr), \\
&\ diegeticEvent(Ex).
\end{aligned} \tag{12.1.4}$$

% eqn:inVisActxPar

$$\begin{aligned}
&mev(T2, addBel(bel(Spx, who(Ex, Pn)))) \leftarrow \\
&\ time(T2), \\
&\ spectator(Spx), \\
&\ visActWo([T1, T2], Spx, Segx, Pn, Ex), \\
&\ diegeticParticipant(Pn), \\
&\ hasIntTime(Segx, [T1, T2]), \\
&\ diegeticEvent(Ex).
\end{aligned} \tag{12.1.5}$$

% eqn:diegeticBelief

$$\begin{aligned}
&mev(Tx, addBel(bel(Spx, Ex))) \leftarrow \\
&\ mev(Tx, addBel(bel(Spx, what(Ex, Actx)))), \\
&\ mev(Tx, addBel(bel(Spx, when(Ex, on([Td1, Td2]))))), \\
&\ mev(Tx, addBel(bel(Spx, who(Ex, Pn)))), \\
&\ mev(Tx, addBel(bel(Spx, where(Ex, Wr)))).
\end{aligned} \tag{12.1.6}$$

When some components are not reported in the diegetic events, the viewer does not believe that such event parts do not exist, but he believes that have not yet been presented in the story. Below I report the viewer cognitive rules for the when, what, who components in the case that they are not yet known.

% The "where" the event happens is unknown

$$\begin{array}{l} mev(Tx, bel(Spx, where(Ex, unknown))) \leftarrow \\ \;mev(Tx, bel(Spx, when(Ex, on([Td1, Td2])))), \\ \;diegeticSpace(Wr), \\ \;not\ mev(Tx, bel(Spx, where(Ex, known))). \end{array} \tag{12.1.7}$$

$$\begin{array}{l} mev(Tx, bel(Spx, where(Ex, known))) \leftarrow \\ \;time(Tx), \\ \;spectator(Spx), \\ \;diegeticSpace(Wr), \\ \;diegeticEvent(Ex), \\ \;Wr! = unknown, \\ \;mev(Tx, bel(Spx, where(Ex, Wr))). \end{array} \tag{12.1.8}$$

% The "what" of the event is unknown

$$\begin{array}{l} mev(Tx, bel(Spx, what(Ex, unknown))) \leftarrow \\ \;mev(Tx, bel(Spx, when(Ex, on([Td1, Td2])))), \\ \;diegeticAction(Actx), \\ \;not\ mev(Tx, bel(Spx, what(Ex, known))). \end{array} \tag{12.1.9}$$

$$\begin{array}{l} mev(Tx, bel(Spx, what(Ex, known))) \leftarrow \\ \;time(Tx), \\ \;spectator(Spx), \\ \;diegeticAction(Actx), \\ \;diegeticEvent(Ex), \\ \;Actx! = unknown, \\ \;mev(Tx, bel(Spx, what(Ex, Actx))). \end{array} \tag{12.1.10}$$

% The "who" of the event is unknown

$$\begin{array}{l} mev(Tx, bel(Spx, who(Ex, unknown))) \leftarrow \\ \;mev(Tx, bel(Spx, when(Ex, on([Td1, Td2])))), \\ \;diegeticParticipant(Pn), \\ \;not\ mev(Tx, bel(Spx, who(Ex, known))). \end{array} \tag{12.1.11}$$

$$\begin{array}{l} mev(Tx, bel(Spx, who(Ex, known))) \leftarrow \\ \;time(Tx), \\ \;spectator(Spx), \\ \;diegeticParticipant(Pn), \\ \;diegeticEvent(Ex), \\ \;Pn! = unknown, \\ \;mev(Tx, bel(Spx, who(Ex, Pn))). \end{array} \tag{12.1.12}$$

12.2 AN COGNITIVE FORMULATION OF RUSSEL & KRAMPS AXIOMATIZATION

The basic rules or temporal reasoning given have been constructed by the axiomatic one by Russell & Kamp(R&K)[1] regarding the reasoning of ordinary events $e1$, $e2$. Logic rules R&K have been defined with two basic temporal binary predicates among the events: $P(e1, e2)$ with the meaning $e1$ precedes $e2$ and $O(e1, e2)$ with the meaning $e1$ overlaps with $e2$ (all the variables expressed with lower case letter are universally quantified):

$$\begin{array}{ll} 1 & P(e1,e2) \Rightarrow \neg P(e2,e1). \\ 2 & P(e1,e2) \wedge P(e2,e3) \Rightarrow P(e1,e3). \\ 3 & O(ex,ex). \\ 4 & O(e1,e2) \Rightarrow O(e2,e1). \\ 5 & P(e1,e2) \Rightarrow \neg O(e1,e2). \\ 6 & P(e1,e2) \wedge O(e2,e3) \wedge P(e3,e4) \Rightarrow P(e1,e4). \\ 7 & P(e1,e2) \vee O(e1,e2) \vee P(e2,e1). \end{array} \tag{12.2.1}$$

My rewriting of the axioms 12.2.1 has been made by considering that those events are argument of Spx spectator's beliefs. For the axiom 1 I have made the following rewriting[2]:

$$\begin{array}{ll} 1 & P(e1,e2) \Rightarrow \neg P(e2,e1) \\ & \qquad\qquad \downarrow \\ 2 & \mathrm{not\ bel}(Spx, \mathrm{prec}(E2,E1)) \leftarrow \mathrm{bel}(Spx, \mathrm{prec}(E1,E2))^{3} \end{array}$$

For the computational treatment in an equivalent way I have represented formula 2, which by rewriting comes out, by means of the constraint:

$$\leftarrow \mathrm{bel}(Spx, \mathrm{prec}(E2,E1)), \mathrm{bel}(Spx, \mathrm{prec}(E1,E2)). \tag{12.2.3}$$

1 The axiomatization was initially built by Russell [Russell] later modified by Kramp [Kramp]
2 I remember that the variables in classic logic are expressed in lower case letter, while in computational logic (Prolog) in capital letter
3 I applied the following equivalence in rewriting:

$$\mathrm{bel}(Spx, \mathrm{not\ prec}(E2,E1)) \leftrightarrow \mathrm{not\ bel}(Spx, \mathrm{prec}(E2,E1)) \tag{12.2.2}$$

Similarly to case 1 I rewrote the other axioms 12.2.1:

$$\mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E3})) \leftarrow \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})),\mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E2},\mathtt{E3})). \tag{12.2.4}$$

Axiom 3 in 12.2.1 has been rewritten as:

$$\mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{Ex},\mathtt{Ex})). \tag{12.2.5}$$

Axiom 4 in 12.2.1 has been rewritten as:

$$\mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E1},\mathtt{E2})) \leftarrow \mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E2},\mathtt{E1})). \tag{12.2.6}$$

While Axiom 5 in 12.2.1 has been rewritten as:

$$\leftarrow \mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E1},\mathtt{E2})),\mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})). \tag{12.2.7}$$

Through the following transformations:

$$\begin{array}{ll}
1 & \mathsf{P}(e1,e2) \Rightarrow \neg\mathsf{O}(e2,e1) \\
\downarrow & \\
2 & \mathtt{bel}(\mathtt{Spx},\mathtt{not\ over}(\mathtt{E2},\mathtt{E1})) \ \leftarrow \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})). \\
\downarrow & \\
3 & \mathtt{not\ bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E2},\mathtt{E1})) \ \leftarrow \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})). \\
\downarrow & \\
4 & \leftarrow \ \ \mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E2},\mathtt{E1})),\mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})).
\end{array}$$

Axiom 6 in 12.2.1 has been rewritten as:

$$\begin{array}{l}
\mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E4})) \leftarrow \\
\ \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})), \\
\ \mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E2},\mathtt{E3})), \\
\ \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E3},\mathtt{E4})).
\end{array} \tag{12.2.8}$$

Finally about the axiom of the time arrow (axiom 7 12.2.1) holds:

$$\leftarrow \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E1},\mathtt{E2})), \quad \mathtt{bel}(\mathtt{Spx},\mathtt{over}(\mathtt{E1},\mathtt{E2})), \quad \mathtt{bel}(\mathtt{Spx},\mathtt{prec}(\mathtt{E2},\mathtt{E1})).$$

$$(12.2.9)$$

At the rewriting of this last inference, we came through the following transformation:

From the axiom (written in the form of temporal logic): $\mathsf{P}(e1,e2) \vee \mathsf{O}(e1,e2) \vee \mathsf{P}(e1,e2)$
we apply De Morgan's law:

$$\neg\ (\neg \mathsf{P}(e1,e2) \wedge \neg \mathsf{O}(e1,e2) \wedge \neg \mathsf{P}(e1,e2))) \tag{12.2.10}$$

The former in computational terms becomes:

$$\begin{aligned}&\mathit{not}\ (\mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2})),\\ &\mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{over}(\mathsf{E1}, \mathsf{E2})\\ &\mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2}))))\end{aligned} \tag{12.2.11}$$

where in ASP formalism can be represented by the following constraint:

$$\begin{aligned}&\leftarrow\ \mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2})),\\ &\quad \mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{over}(\mathsf{E1}, \mathsf{E2}),\\ &\quad \mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2}))).\end{aligned} \tag{12.2.12}$$

To the group of seven axioms present in 12.2.1 I have added two new axioms:

$$\begin{aligned}&8\quad \mathsf{O}(e1,e2)\ \wedge\ \mathsf{P}(e2,e3)\ \Rightarrow \neg \mathsf{P}(e3,e1)\\ &9\quad \mathsf{O}(e2,e3)\ \wedge\ \mathsf{P}(e1,e2)\ \Rightarrow \neg \mathsf{P}(e3,e1)\end{aligned}$$

which translated into the beliefs of a rational agent (the spectator) become:

$$\begin{aligned}&8'\ \mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E3}, \mathsf{E1})) \leftarrow\\ &\qquad \mathsf{bel}(\mathsf{Spx}, \mathsf{over}(\mathsf{E1}, \mathsf{E2})),\\ &\qquad \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E2}, \mathsf{E3})).\\ &9'\ \mathit{not}\ \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E3}, \mathsf{E1})) \leftarrow\\ &\qquad \mathsf{bel}(\mathsf{Spx}, \mathsf{over}(\mathsf{E2}, \mathsf{E3})),\\ &\qquad \mathsf{bel}(\mathsf{Spx}, \mathsf{prec}(\mathsf{E1}, \mathsf{E2})).\end{aligned} \tag{12.2.13}$$

Since we are unable to handle computational negations present in in the heads of clauses 8 and 9, we write the two axioms as constraints in the following manner:

$$
\begin{aligned}
&8\text{''} \leftarrow \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E3}, \mathrm{E1})),\\
&\quad \mathrm{bel}(\mathrm{Spx}, \mathrm{over}(\mathrm{E1}, \mathrm{E2})), \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E2}, \mathrm{E3})).\\
&9\text{''} \leftarrow \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E3}, \mathrm{E1})),\\
&\quad \mathrm{bel}(\mathrm{Spx}, \mathrm{over}(\mathrm{E2}, \mathrm{E3})),\\
&\quad \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E1}, \mathrm{E2})).
\end{aligned}
\tag{12.2.14}
$$

In the formalism I have defined every belief is a fluent one that varies over time, so in the representation of belief one must consider the time in the representation:

$$\mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{Ex}, \mathrm{Ey}))) \; \mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{over}(\mathrm{Ex}, \mathrm{Ey})))$$

Ultimately, the complete axiomatic proposal for the spectator's temporal reasoning is shown in the following inferences.

% Axiom 1 Consistence of the relationship prec(E2,E1)

$$
\begin{aligned}
&-\mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E2}, \mathrm{E1}))) \leftarrow\\
&\quad \mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E1}, \mathrm{E2}))),\\
&\quad \mathrm{time}(\mathrm{Tx}).
\end{aligned}
\tag{12.2.15}
$$

% Axiom 2 Transitivity of the relationship prec(E2,E1).

$$
\begin{aligned}
&\mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E1}, \mathrm{E3}))) \leftarrow\\
&\quad \mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E1}, \mathrm{E2}))),\\
&\quad \mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{prec}(\mathrm{E2}, \mathrm{E3}))),\\
&\quad \mathrm{time}(\mathrm{Tx}).
\end{aligned}
\tag{12.2.16}
$$

% Axiom 3 Each Ex event overlaps with itself

$$
\begin{aligned}
&\mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{over}(\mathrm{Ex}, \mathrm{Ex}))) \leftarrow\\
&\quad \mathrm{time}(\mathrm{Tx}), \mathrm{diegeticEvent}(\mathrm{Ex}),\\
&\quad \mathrm{spectator}(\mathrm{Spx}),\\
&\quad \mathrm{time}(\mathrm{Tx}).
\end{aligned}
\tag{12.2.17}
$$

% Axiom 4 Symmetry of the relationship over

$$
\begin{aligned}
&\mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{over}(\mathrm{E1}, \mathrm{E2}))) \leftarrow\\
&\quad \mathrm{mev}(\mathrm{Tx}, \mathrm{bel}(\mathrm{Spx}, \mathrm{over}(\mathrm{E2}, \mathrm{E1}))),\\
&\quad \mathrm{time}(\mathrm{Tx}).
\end{aligned}
\tag{12.2.18}
$$

% Axiom 5 Or exclusivity between the relationships over and prec

$$\begin{aligned}&-mev(Tx, bel(Spx, over(E1, E2))) \leftarrow \\ &\ mev(Tx, bel(Spx, prec(E1, E2))), \\ &\ time(Tx).\end{aligned} \tag{12.2.19}$$

% Axiom 6

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E4))) \leftarrow \\ &\ mev(Tx, bel(Spx, prec(E1, E2))), \\ &\ mev(Tx, bel(Spx, over(E2, E3))), \\ &\ mev(Tx, bel(Spx, prec(E3, E4))), \\ &time(Tx).\end{aligned} \tag{12.2.20}$$

% Axiom 7 Axiom of Temporal Arrow as Constraint and conflict

$$\begin{aligned}&tArrowConflict(Tx, E1, E2) \leftarrow \\ &\ not\ mev(Tx, bel(Spx, prec(E1, E2))), \\ &\ not\ mev(Tx, bel(Spx, prec(E2, E1))), \\ &\ not\ mev(Tx, bel(Spx, over(E1, E2))), \\ &\ time(Tx), spectator(Spx), \\ &diegeticEvent(E1), diegeticEvent(E2).\end{aligned} \tag{12.2.21}$$

% Axiom 8

$$\begin{aligned}&-mev(Tx, bel(Spx, prec(E3, E1))) \leftarrow \\ &\ mev(Tx, bel(Spx, over(E1, E2))), \\ &\ mev(Tx, bel(Spx, prec(E2, E3))), time(Tx).\end{aligned} \tag{12.2.22}$$

% Axiom 9

$$\begin{aligned}&-mev(Tx, bel(Spx, prec(E3, E1))) \leftarrow \\ &\ mev(Tx, bel(Spx, over(E2, E3))), \\ &\ mev(Tx, bel(Spx, prec(E1, E2))), time(Tx).\end{aligned} \tag{12.2.23}$$

% Axiom 10 temporal conflict

$$\begin{aligned}&tempConflict(Tx, E1, E2) \leftarrow \\ &\ mev(Tx, bel(Spx, prec(E1, E2))), \\ &\ mev(Tx, bel(Spx, prec(E2, E1))).\end{aligned} \tag{12.2.24}$$

12.3 CAUSAL AXIOMATIC

The causal axiomatic I present is a variation of the axiomatic defined in [Mele2013]:

$$
\begin{array}{ll}
mev(Tx, bel(Spx, cause(A, and(B, C)))) \leftarrow & \text{\% \textbf{And}} \\
\quad mev(Tx, bel(Spx, cause(A, B))), & \\
\quad mev(Tx, bel(Spx, cause(A, C))). & \\
 & \\
mev(Tx, bel(Spx, cause(or(A, B), C))) \leftarrow & \text{\% \textbf{Or}} \\
\quad mev(Tx, bel(Spx, cause(A, C))), & \\
\quad mev(Tx, bel(Spx, cause(B, C))). & \\
- & \\
mev(Tx, bel(Spx, cause(A, C))) \leftarrow & \text{\% \textbf{Cut}} \\
\quad mev(Tx, bel(Spx, cause(A, B))), & \\
\quad mev(Tx, bel(Spx, cause(and(A, B), C))). & \\
- & \\
mev(Tx, bel(Spx, cause(and(A, C), B))) \leftarrow & \text{\% \textbf{Left Monotonicity}} \\
\quad mev(Tx, bel(Spx, cause(A, B))), & \\
\quad mev(Tx, bel(Spx, C)), & \\
\quad mev(Tx, bel(Spx, prec(C, B))). & \\
- & \\
mev(Tx, bel(Spx, cause(A, or(B, C)))) \leftarrow & \text{\% \textbf{Right Monotonicity}} \\
\quad mev(Tx, bel(Spx, cause(A, B))), & \\
\quad mev(Tx, bel(Spx, C)), & \\
\quad mev(Tx, bel(Spx, prec(A, C))). & \\
 & \\
mev(Tx, bel(Spx, cause(and(A, B), C))) \leftarrow & \text{\% \textbf{Substitution}} \\
\quad mev(Tx, bel(Spx, cause(and(A, D), C))), & \\
\quad mev(Tx, bel(Spx, cause(B, D))). &
\end{array}
\tag{12.3.1}
$$

Corollaries

$$\begin{aligned}&mev(Tx, bel(Spx, cause(A, C))) \leftarrow \quad \textbf{\% Transitivity}\\ &\quad mev(Tx, bel(Spx, cause(A, B))),\\ &\quad mev(Tx, bel(Spx, cause(B, C))).\end{aligned} \tag{12.3.2}$$

At the axioms presented I have considered[4]:

$$\begin{aligned}&\leftarrow mev(Tx, bel(Spx, cause(E1, E2))), \quad \textbf{\% Causal Inconsistency}\\ &\quad mev(Tx, bel(Spx, cause(E2, E1))).\\ &\quad \text{or even alternatively:}\\ &-mev(Tx, bel(Spx, cause(E2, E1))) \leftarrow \quad \textbf{\% Causal Inconsistency}\\ &\quad mev(Tx, bel(Spx, cause(E1, E2))).\end{aligned} \tag{12.3.3}$$

The axiom that connects the temporal axiomatics proposed with the causal just presented, is the fundamental axiom many times used for the construction of cognitive models in this book:

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E2))) \leftarrow\\ &\quad mev(Tx, bel(Spx, cause(E1, E2))),\\ &\quad mev(Tx, bel(Spx, E1)),\\ &\quad mev(Tx, bel(Spx, E2)).\end{aligned}$$

I also propose the following consistency control axioms:

$$\begin{aligned}&-mev(Tx, bel(Spx, prec(E2, E1))) \leftarrow\\ &\quad mev(Tx, bel(Spx, cause(E1, E2))).\\[1em] &-mev(Tx, bel(Spx, eq(E1, E2))) \leftarrow\\ &\quad mev(Tx, bel(Spx, cause(E1, E2))).\end{aligned} \tag{12.3.4}$$

4 The following and other axioms of controlling causal inconsistencies that will follow in this appendix have not been fully tested in the adopted ASP formalism. I have included these formulations despite not having this requirement as they could be a point of inspiration for some future research.

Often, in my formalism to represent cognitive rules, I used the expression $mev(Tx, bel(Spx, eq(E1, E2)))$. In order to use the axiomatic above cited I have considered the following relationship[5]:

$$\begin{aligned} & mev(Tx, bel(Spx, over(E1, E2))) \leftarrow \\ & \; mev(Tx, bel(Spx, eq(E1, E2))), \\ & \; diegeticEvent(E1), diegeticEvent(E2), \\ & \; time(Tx), spectator(Spx). \end{aligned} \tag{12.3.6}$$

Some inferences using the precedence relation (prec) and the simultaneous relationship (eq) are useful. In qualitative form: E1 precedes E3, if E2 is simultaneous with E3, and E1 precedes E2. Formally:

$$\begin{aligned} & mev(Tx, bel(Spx, prec(E1, E3))) \leftarrow \\ & \; mev(Tx, bel(Spx, eq(E2, E3))), \\ & \; mev(Tx, bel(Spx, prec(E1, E2))). \end{aligned} \tag{12.3.7}$$

Or also: $E1$ precedes $E3$ if $E1$ is simultaneous with $E2$ and $E1$ precedes $E2$. Formally:

$$\begin{aligned} & mev(Tx, bel(Spx, prec(E1, E3))) \leftarrow \\ & \; mev(Tx, bel(Spx, eq(E1, E2))), \\ & \; mev(Tx, bel(Spx, prec(E2, E3))). \end{aligned} \tag{12.3.8}$$

Finally, I include in my axiomatic two other axioms that use the causal relation $cause(Ex, Ey)$.

5 Remember that the following definition is also valid:

$$\begin{aligned} & mev(Tx, bel(Spx, eq(E1, E2))) \leftarrow \\ & \; mev(Tx, bel(Spx, when(E1, on([Td1, Td2])))), \\ & \; mev(Tx, bel(Spx, when(E2, on([Td3, Td4])))), \\ & \; Td1 = Td3, Td2 = Td4, \\ & \; diegeticEvent(E1), diegeticEvent(E2), \\ & \; diegeticTime(Td1), diegeticTime(Td2), \\ & \; diegeticTime(Td3), diegeticTime(Td4), \\ & \; time(Tx), spectator(Spx). \end{aligned} \tag{12.3.5}$$

E1 precedes E3 if E1 causes E2, and E2 is simultaneous with E3. Formally:

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E3))) \leftarrow \\ &\ mev(Tx, bel(Spx, eq(E2, E3))), \\ &\ mev(Tx, bel(Spx, cause(E1, E2))).\end{aligned} \tag{12.3.9}$$

E1 precedes E3 if E1 is simultaneous with E2 and E2 cause E3.

$$\begin{aligned}&mev(Tx, bel(Spx, prec(E1, E3))) \leftarrow \\ &\ mev(Tx, bel(Spx, eq(E1, E2))), \\ &\ mev(Tx, bel(Spx, cause(E2, E3))).\end{aligned} \tag{12.3.10}$$

12.4 INTEGRATION OF COGNITIVE RUSSEL & KRAMPS AXIOMATIZATION WITH EVENT CALCULUS

Tha axiomatics of event calculus I present was built starting from the formalism reported in [Muller2014]

% DEC1

$$\begin{aligned}&stoppedIn(T1, F, T2) \leftarrow \\ &\ mev(T, E), T1 < T, T < T2, \\ &\ terminates(T, E, F), event(E), fluent(F), time(T), \\ &\ time(T1), time(T2).\end{aligned} \tag{12.4.1}$$

% DEC2

$$\begin{aligned}&startedIn(T1, F, T2) \leftarrow \\ &\ mev(T, E), T1 < T, T < T2, \\ &initiates(T, E, F), event(E), fluent(F), time(T), \\ &time(T1), time(T2).\end{aligned} \tag{12.4.2}$$

% DEC3

$$\begin{aligned}&\mathit{mev}(D, F2) \leftarrow\\ &\mathit{mev}(T1, E), \mathit{initiates}(T1, E, F1), 0 < T2,\\ &\mathit{trajectory}(F1, T1, F2, T2), \text{not } \mathit{stoppedIn}(T1, F1, D),\\ &\mathit{event}(E), \mathit{fluent}(F1), \mathit{fluent}(F2), \mathit{time}(T1), \mathit{time}(T2), \mathit{time}(D),\\ &D < \mathit{maxtime}, \mathit{addition}(D, T1, T2).\end{aligned} \tag{12.4.3}$$

$$\mathit{addition}(D, T1, T2) \leftarrow D = T1 + T2, \mathit{time}(D), \mathit{time}(T1), \mathit{time}(T2).$$

% DEC4

$$\begin{aligned}&\mathit{mev}(D, F2) \leftarrow\\ &\mathit{mev}(T1, E), \mathit{terminates}(T1, E, F1),\\ &0 < T2, \mathit{antiTrajectory}(F1, T1, F2, T2), \text{not } \mathit{startedIn}(T1, F1, D),\\ &\mathit{event}(E), \mathit{fluent}(F1), \mathit{fluent}(F2), \mathit{time}(T1),\\ &\mathit{time}(T2), \mathit{time}(D), D < \mathit{maxtime}, \mathit{addition}(D, T1, T2).\end{aligned} \tag{12.4.4}$$

% DEC5

$$\begin{aligned}&\mathit{initiated1}(T, F) \leftarrow\\ &\mathit{mev}(T, E), \mathit{initiates}(T, E, F), \mathit{event}(E),\\ &\mathit{fluent}(F), \mathit{time}(T).\end{aligned} \tag{12.4.5}$$

% DEC6

$$\begin{aligned}&\mathit{terminated1}(T, F) \leftarrow\\ &\quad \mathit{mev}(T, E), \mathit{terminates}(T, E, F), \mathit{event}(E), \mathit{fluent}(F), \mathit{time}(T).\end{aligned} \tag{12.4.6}$$

% DEC7

$$\begin{aligned}&\mathit{released1}(T, F) \leftarrow\\ &\mathit{mev}(T, E), \mathit{releases}(T, E, F), \mathit{event}(E), \mathit{fluent}(F), \mathit{time}(T).\end{aligned} \tag{12.4.7}$$

% DEC8

$$\begin{aligned}&\mathit{mev}(T1, F) \leftarrow\\ &\mathit{mev}(T, F),\\ &\mathit{notreleasedAt}(T1, F),\\ &\mathit{notterminated1}(T, F),\\ &\mathit{fluent}(F), \mathit{time}(T), T < \mathit{maxtime}, \mathit{inc}(T, T1),\\ &\mathit{time}(T1).\end{aligned} \tag{12.4.8}$$

% DEC9

$$\begin{aligned}&-\mathit{mev}(T1, F) \leftarrow\\ &-\mathit{mev}(T, F),\\ &\mathit{notreleased}(T1, F), \text{not } \mathit{terminated1}(T, F), \mathit{fluent}(F), \mathit{time}(T),\\ &T < \mathit{maxtime}, \mathit{inc}(T1, T).\end{aligned} \tag{12.4.9}$$

% DEC10

$$\begin{aligned}&\mathit{releasedAt}(T1, F) \leftarrow\\ &\mathit{releasedAt}(T, F), \mathit{notinitiated1}(T, F),\ \text{not } \mathit{terminated1}(T, F), \mathit{fluent}(F),\\ &\quad \mathit{time}(T), T < \mathit{maxtime}, \mathit{inc}(T1, T).\end{aligned} \tag{12.4.10}$$

% DEC11

$$\begin{aligned}&\leftarrow releasedAt(T1, F), not\ releasedAt(T, F), notreleased1(T, F),\\&fluent(F), time(T), T < maxtime, inc(T1, T).\end{aligned} \tag{12.4.11}$$

% DEC12

$$\begin{aligned}&mev(T1, F) \leftarrow\\&mev(T, E), initiates(T, E, F), event(E),\\&fluent(F), time(T), T < maxtime, inc(T, T1), time(T1).\end{aligned} \tag{12.4.12}$$

% DEC13

$$\begin{aligned}&-mev(T1, F) \leftarrow\\&mev(T, E), terminates(T, E, F), event(E),\\&fluent(F), time(T), T < maxtime, inc(T, T1), time(T1).\end{aligned} \tag{12.4.13}$$

% DEC14

$$\begin{aligned}&releasedAt(T1, F) \leftarrow\\&mev(T, E), releases(T, E, F), event(E),\\&fluent(F), time(T), T < maxtime, inc(T1, T).\end{aligned} \tag{12.4.14}$$

% DEC15

$$\begin{aligned}&\leftarrow releasedAt(T1, F), mev(T, E), initiates(T, E, F),\\&event(E), fluent(F), time(T), T < maxtime, inc(T1, T).\end{aligned} \tag{12.4.15}$$

% DEC16

$$\begin{aligned}&started(T, F) \leftarrow\\&mev(T, F), fluent(F), time(T).\end{aligned} \tag{12.4.16}$$

% DEC17

$$\begin{aligned}&started(T, F) \leftarrow\\&notnotMev(T, E),\\&notnotInitiates(T, E, F),\\&event(E), fluent(F), time(T).\end{aligned} \tag{12.4.17}$$

% DEC18

$$stopped(T, F) \leftarrow not\ mev(T, F), fluent(F), time(T). \tag{12.4.18}$$

% DEC19

$$\begin{aligned}&stopped(T, F) \leftarrow\\&notnotMev(T, E),\\&notnotTerminates(T, E, F),\\&event(E), fluent(F), time(T).\end{aligned} \tag{12.4.19}$$

% DEC20

$$\begin{aligned}&\mathit{initiated}(T,F) \leftarrow \\ &\mathit{started}(T,F), \text{not } \mathit{terminated1}(T,F).\end{aligned} \tag{12.4.20}$$

% DEC21

$$\begin{aligned}&\mathit{terminated}(T,F) \leftarrow \\ &\mathit{stopped}(T,F), \text{not } \mathit{initiated1}(T,F).\end{aligned} \tag{12.4.21}$$

% Funzioni ausiliarie

$$\begin{aligned}&\mathit{notMev}(T,E) \leftarrow \\ &\mathit{notmev}(T,E), \mathit{time}(T), \mathit{event}(E). \\ &\mathit{notInitiates}(T,E,F) \leftarrow \text{not } \mathit{initiates}(T,E,F), \mathit{time}(T), \mathit{fluent}(F), \mathit{event}(E).\end{aligned} \tag{12.4.22}$$

$$\mathit{inc}(T,T1) : -T1 = T + 1, \mathit{time}(T), \mathit{time}(T1).$$

```
% Declaration of events

% BELIEFS ON EVENTS
fluent(bel(Spx, Ex)):- spectator(Spx),
   diegeticEvent(Ex).

fluent(bel(Spx, prec(E1,E2))):-
  spectator(Spx),
   diegeticEvent(E1),
   diegeticEvent(E2).

fluent(bel(Spx, over(E1,E2))):-
   spectator(Spx),
   diegeticEvent(E1),
   diegeticEvent(E2).

 fluent(bel(Spx, cause(E1,E2))):-
   spectator(Spx),
   diegeticEvent(E1),
   diegeticEvent(E2).

%Declaration of events

event(addBel(bel(Spx, prec(E1,E2)))):-
  spectator(Spx),
  diegeticEvent(E1),
  diegeticEvent(E2).

event(addBel(bel(Spx, over(E1,E2)))):-
  spectator(Spx),
  diegeticEvent(E1),
  diegeticEvent(E2).

event(addBel(bel(Spx, cause(E1,E2)))):-
```

```
  spectator(Spx),
  diegeticEvent(E1),
  diegeticEvent(E2).

event(addBel(bel(Spx, Ex))):-
  spectator(Spx),
  diegeticEvent(Ex).

% Examples of Axioms
initiates(Tx, addBel(bel(Spx, prec(E1,E2))), bel(Spx, prec(E1,E2))):-
   spectator(Spx),
   diegeticEvent(E1),
   diegeticEvent(E2),
   time(Tx).

initiates(Tx, addBel(bel(Spx, over(E1,E2))), bel(Spx, over(E1,E2))):-
   spectator(Spx),
   diegeticEvent(E1),
   diegeticEvent(E2),
   time(Tx).

initiates(Tx, addBel(bel(Spx, Ex)), bel(Spx, Ex)):-
   diegeticEvent(Ex),
   time(Tx),
   spectator(Spx).

% Examples of RULES
mev(Tx, addBel(bel(Spx, prec(E1,E2)))):-
  mev(Tx, bel(Spx, E1)),
  mev(Tx, bel(Spx, E2)),
  mev(Tx, bel(Spx, cause(E1,E2))),
  time(Tx),
  spectator(Spx),
  diegeticEvent(E1),
  diegeticEvent(E2).

% Examples of NARRATIVE

diegeticEvent(e1).
diegeticEvent(e2).
diegeticEvent(e3).
spectator(spx).

mev(1, bel(spx, e1)).
mev(1, bel(spx, e2)).
%mev(2, addBel(bel(spx, prec(e2,e3)))).
%
mev(1,bel(spx, prec(e1,e2))).
mev(1,bel(spx, prec(e2,e3))).
%mev(1,bel(spx, prec(e2,e3))).
%mev(1,bel(spx, cause(e1,e2))).

%:-mev(0,bel(spx,e1)).
%:-mev(0,bel(spx,e3)).
```

```
%:-mev(0,bel(spx,prec(e1,e2))).
%:-mev(0,bel(spx,prec(e2,e3))).
%:-mev(0,bel(spx,prec(e1,e3))).

%:-mev(T,bel(spx,prec(E1,E2))),E1=E2.
%:-mev(T,bel(Spx,cause(E1,E2))),E1=E2.
%:-mev(T, bel(Spx,prec(E1,E2))),mev(T, bel(Spx, prec(E2,E1))).
% La precedente ?elimina tutto il set

%:-mev(T,bel(Spx,cause(E1,E2))),mev(T,bel(Spx, cause(E2,E1))).

%:-holdsAt(bel(spx,prec(e2,e3)),0).
%:-holdsAt(bel(spx,cause(e1,e2)), 0).

%:- releasedAt(F,T), fluent(F),time(T).
%:-releasedAt(F,0), fluent(F).
```

12.5 ON THE QUESTION OF USING A PROBABILITY FACTOR FOR BELIEFS

As a starting point for the discussion[6]I report an excerpt present in the book of S. Galvan endnote cite Galvan p. 212:

> When it is claimed that a person A believes that the state of affairs indicated by α is worth, one usually does not intend to specify the degree of belief that A attributes to α. The belief by A that α can mean that according to A the probability of α relative to $\neg\alpha$ is greater than $1/2$ (and in that case it is said that " A presumes α), both that according to A the probability of α is equal to 1, and that of $\neg\ \alpha$ to 0 (and if so says A is convinced that α).

S. Galvan therefore assumes that when a person says he believes α, he intrinsically associates a probability with belief of $1/2$. Taking S. Galvan's assertion as a reference, I report in the 12.5.2 table some examples of representations of beliefs where a probability associated with the beliefs is implicitly

6 I wrote this note after a discussion that I had with Antonio Origlia on a long train journey that we made together in Bari to participate in a joint conference. I thank Antonio who with his comments made me reflect and have more awareness of some choices I made in this book on the representation of beliefs.

or explicitly used. To make a comparison I consider the following generalized representation of belief.

bel(Tx, Ax, Obx, Gp)

Tx	*Time in which the belief holds*	(12.5.1)
Ax	*Person who owns the belief*	
Obx	*Object of belief*	
Gp	*Probability of belief*	

The comparison is the following:

Autors	**Tx**	**Ax**	**Obx**	**Gp**	**Formalism**
CastMiceli	–	Ax	Ex (Event)	$> 0,5$	$belAx(Possible\ Ex)$
Galvan	–	Ax(implic.)	α (Proposition)	$= 0,6$	$bel(\alpha)$
Mele(in this book)	Tx	Spx	Ex (Event)	$= 1$	$mev(Tx, bel(Ax, Ex))$
EventCalculus	Tx	Ax	Action	$= 1$	$HoldsAt(Believe(Ax, -, Action), Tx)$

(12.5.2)

In the book [Miceli2015] there is a notion of explicit probability defined through pseudo objectives (not explicitly represented in the cognitive space of the agent) that arise from the agents' past experiences.

The construction of inferences rules built on previous knowledge is the point I wish to discuss.

I hypothesize that with regard to the spectator's beliefs the probability C is of three types:

1. the probability C that emerges from the viewing of Spx of previous films
2. the probability C which is determined by the knowledge / inferences induced by the daily life of Spx
3. the probability C that is determined by the beliefs of Spx arising from events in the story seen previously in the film

For points 1, 2 and 3 reported (in particular for points 1 and 2) we are in a sort of impossibility on a practical level to know the previous experiences of the spectator. But even if this were possible, perhaps taking into consideration very limited types of spectators, this would entail a proliferation of cognitive profiles that arises from the existence of a great variety of past experiences possessed by each spectator. In the reported theory we are interested in building an idealized model of spectator and therefore in cognitive processes that are common to a large number of types of people. We entrust a builder of cognitive models Ox with the task of carrying out this synthesis. In a subsequent step it will be necessary to validate the models proposed by Ox. For point 3. one could think of adopting the probability in the representation (not connected past experiences) but only from the typologies of the inferences used - for example

$$\begin{array}{l} \mathrm{bel}(Ax, Ex, C) \leftarrow \\ \text{a } C_i \text{ perceptive act holds 1} \\ \text{in each condition defined through a negation for failure the } C_j \\ \text{argument of the believe (bel) holds } 0.6 \\ C = C_i \ast C_j \end{array} \tag{12.5.3}$$

The latter is only an example of a possible extension of the theory reported so far in this book. In this direction of analysis I will not investigate further.

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In this book I proposed a methodology to build models for understanding film stories, focusing my attention mainly on aspects of the viewer's temporal reasoning while watching a film.

The work has been developed by adopting a cognitive approach through the examination of the acquisition mechanisms and review of the same viewer's beliefs, about the events of a film story. Through this representation I proposed various models of reasoning having the objective of formulating a computational model for the construction of the fabula. The main mechanisms of cinematographic narration (ellipse, flashback, flashforward, suspense, surprise…) are represented in this book as inferential rules using formal axiomatizations of the research area of Artificial Intelligence. I also provided a measure of the degree of story fragmentation, which can be considered as the cognitive cost of a generic viewer, for the understanding of the story itself. The puzzle films, the counterfactual stories, those related to time travels and levels of reality constituted the analytical material that inspired the proposed models. Although our attention has been given to the temporal aspects, and to the main cognitive mechanisms used by the spectator for building the fabula, I believe that the proposed methods may constitute a methodology for the construction of more complex cognitive models of cinematographic relevance, regarding the identification, the expectations and other type of spectator's emotions.

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I teach Artificial Intelligence at University Parthenope of Naples and, I am associated researcher at Institute of Applied Sciences and Intelligent Systems (ISASI) of Italian National Research Council (CNR). For twenty years I have been an inspirer and coordinator of several research projects concerning: Human Computer Interaction, Natural Language Processing, Computational Cognitive Models,and Artificial Intelligence for Cultural Heritage. In the same period of time I also have been an teacher of discipline in the field of Artificial Intelligence at the University Federico II of Naples and University Parthenope of Naples. For more than a decade teacher of Semiology of Cinema at the University Institute Martucci of Salerno. I was directive member of Italian Association for Artificial Intelligence (AIxIA) and I was member of Cybernetics Institute Council (CNR). I was coordinator of working group "Artificial Intelligence & Cultural Heritage (AI & CH)" of AIxIA. I was founder and leader of Semantic Multimedia and Cognitive Multimodal Systems group of ISASI Institute (CNR).

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