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# Computational Modeling of Narrative

Inderjeet Mani

*Synthesis Lectures on Human Language Technologies*

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# Synthesis Lectures on Human Language Technologies

Editor
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# Computational Modeling of Narrative

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Children's Organization of Southeast Asia

*SYNTHESIS LECTURES ON HUMAN LANGUAGE TECHNOLOGIES #18*

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## ABSTRACT

The field of narrative (or story) understanding and generation is one of the oldest in natural language processing (NLP) and artificial intelligence (AI), which is hardly surprising, since storytelling is such a fundamental and familiar intellectual and social activity. In recent years, the demands of interactive entertainment and interest in the creation of engaging narratives with life-like characters have provided a fresh impetus to this field. This book provides an overview of the principal problems, approaches, and challenges faced today in modeling the narrative structure of stories. The book introduces classical narratological concepts from literary theory and their mapping to computational approaches. It demonstrates how research in AI and NLP has modeled character goals, causality, and time using formalisms from planning, case-based reasoning, and temporal reasoning, and discusses fundamental limitations in such approaches. It proposes new representations for embedded narratives and fictional entities, for assessing the pace of a narrative, and offers an empirical theory of audience response. These notions are incorporated into an annotation scheme called NarrativeML. The book identifies key issues that need to be addressed, including annotation methods for long literary narratives, the representation of modality and habituality, and characterizing the goals of narrators. It also suggests a future characterized by advanced text mining of narrative structure from large-scale corpora and the development of a variety of useful authoring aids.

This is the first book to provide a systematic foundation that integrates together narratology, AI, and computational linguistics. It can serve as a narratology primer for computer scientists and an elucidation of computational narratology for literary theorists. It is written in a highly accessible manner and is intended for use by a broad scientific audience that includes linguists (computational and formal semanticists), AI researchers, cognitive scientists, computer scientists, game developers, and narrative theorists.

## KEYWORDS

narrative modeling, digital storytelling, computational narrative, story understanding, story generation, interactive fiction, character modeling, planning, case-based reasoning, temporal reasoning, plot, narratology

*In memory of my parents, who taught me to value curiosity.*

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# Preface

The field of literary theory called narratology evolved out of 20th century Russian formalism and European structuralism, but has its precursors in classical Greek philosophy. This field has developed sophisticated concepts and many illustrative examples related to aspects of narrative related to time, plot, narrative embedding, narrative voice, characterization, emotion, reader and audience response, point-of-view, etc. Similar notions have been given embodiments in artificial intelligence and formal semantic approaches to narrative.

However, there is no book providing foundational accounts of these narratological concepts in formal and computational terms. My earlier book *The Imagined Moment* examined the intersection of narratological views of time in literature with work on temporal information extraction. The present book is broader in scope, addressing narrative in the large rather than just time. I have tried to be as precise as possible, to make the book relevant to AI and game developers while still retaining, I hope, the interest of literary theorists.

In recent years, the demands of interactive entertainment, and interest in the creation of engaging narratives with life-like characters, have provided a fresh impetus to computational storytelling. Workshops on narrative have been the focus of AAAI Symposia in 1995 (Interactive Story Systems: Plot and Character), 1999 (Narrative Intelligence), 2002 (Artificial Intelligence and Interactive Entertainment), 2007 (Intelligent Narrative Technologies (INT1)), and 2009 (INT2). The INT3 workshop was held in 2010, co-located at the International Conference on the Foundations of Digital Games (FDG), and INT4 at the 2011 AI and Interactive Digital Entertainment Conference (AIIDE). In addition, the Interactive Storytelling (ICIDS) conferences have been held in 2008, 2009, 2010, and 2011, the International Conference on Virtual Storytelling (ICVS) in 2001, 2003, 2005, and 2007, the Technologies for Interactive Digital Storytelling and Entertainment (TIDSE) conferences in 2003, 2004, and 2006, and the Computational Models of Narrative (CMN) workshop in 2009 and 2012. This flurry of activity on narrative, much of it highly inter-disciplinary, makes a book of this kind especially relevant.

I am extremely grateful to Jan Christoph Meister and David Elson for their reviews of a draft of the book, and to series editor Graeme Hirst for helping to chaperone this book from inception to final manuscript. I am also indebted to the many authors whose contributions I have cited here. Finally, I would like to thank my family once again for all their moral support!

Inderjeet Mani
*Chiang Mai, Thailand*
*December 1, 2012*

# CHAPTER 1

# Narratological Background

## 1.1 INTRODUCTION

Storytelling is one of our most fundamental and familiar intellectual and social activities, with homo sapiens often characterized as *the* storytelling animal. The habit has been with us a long time; the cave paintings at Lascaux, dating back 17,000 years, tell their animal tales using narrative techniques including sequencing in time. While the art of narrative has been practiced since antiquity, so has its study; some of the earliest aesthetic theories pertaining to narrative include those of Aristotle (384-322 BCE) and Longinus (100 or 200 CE) in Greece and Bharata (200 BCE or 200 CE) in India. Today, guidelines for narrative construction are commonplace, with narrative concepts used informally in reviews and discussions of books, movies, plays, etc. **Narratology** is a theory of narrative structure, derived from literary criticism. It is "a humanities discipline dedicated to the study of the logic, principles, and practices of narrative representation" (Meister, 2011).

This book tries to show how core narratological concepts can be represented in computational terms, with a view to making concepts from this extremely rich and stimulating theoretical area relevant and accessible to practitioners of natural language processing (NLP) and artificial intelligence (AI). For these practitioners, including those who are seeking to build better interactive systems and game environments, it is imperative to be cognizant of the field of narratology and the theoretical approaches that have evolved around key concepts that system developers have to represent, including character, plot, time, narrator, audience, and point-of-view. For these concepts to be made relevant to this audience, they have to be made precise and represented in computational terms. My book is thus a narratology primer aimed at computer scientists. However, I also strongly hope that the computational framing of classical narratological concepts will contribute in some small way to further refinement and clarification of concepts in humanities narratology.

Although its antecedents lie in classical theories of aesthetics, narratology derives more directly from the intrinsically language- and linguistics-centered approaches to literature fostered by the Russian formalists (in the early years of the 20th century) and later through European structuralism, among whom the most influential names are Russian and French scholars like Bakhtin, Barthes, Bremond, Genette, Propp, Shlovsky, and Todorov (the last of whom, in 1969, introduced the term *narratology*). In addition to studying traditional topics such as plot and character, these scholars also provided compelling accounts of the way time and point-of-view are expressed in narrative. These approaches make narratology especially interesting to computational and corpus linguists.

The 1980s onward has seen the growth in the humanities of *post-classical* narratology, which retains an interest in language but which is focused around two active subfields:

i) cognitive narratology, i.e., "the story-producing activities of tellers, the processes by means of which interpreters make sense of the narrative worlds (or *storyworlds*) evoked by narrative representations or artifacts, and the cognitive states and dispositions of characters in those storyworlds" (Herman, 2011);

ii) contextualist narratology, which, inspired by European 'theories' of deconstruction, relates "the phenomena encountered in narrative to specific cultural, historical, thematic, and ideological contexts" (Meister, 2011). While no doubt interesting contextualist narratology is less relevant to computation, in part because computation has not advanced enough to deal adequately with such topics.

The narratological developments in the humanities have been paralleled in the last half-century by the growth of computational approaches to narrative. This has resulted in systems for generating and understanding stories. More recently, the demands of interactive entertainment, and interest in the creation of engaging narratives with life-like characters, have given rise to interactive fiction, drama, and advanced computer game environments. These endeavors have created computational instantiations of narrative constructs, formulating (sometimes implicitly) theoretical and empirical approaches to narrative. **Computational narratology** examines narratology from "the point of view of computation and information processing," focusing on (from Mani (2012)):

> the algorithmic processes involved in creating and interpreting narratives, modeling narrative structure in terms of formal, computable representations. Its scope includes the approaches to storytelling in artificial intelligence (AI) systems and computer (and video) games, the automatic interpretation and generation of stories, and the exploration and testing of literary hypotheses through mining of narrative structure from corpora.

This book falls squarely within computational narratology, but reaches out to connect systematically with notions from humanities narratology. This chapter provides an introduction to classical narratological notions taken from literary theory. I illustrate them with well-known literary examples, along with occasional references to cinematic media. I also provide core computational representations for fundamental narratological entities. At the end of each chapter, to help clarify concepts, I develop a data structure to represent the distinctions that have been introduced. This is expressed in the form of a new annotation scheme for narrative corpora called NarrativeML. Corpora marked by humans with this scheme can be used to automatically train systems to reproduce the annotation. Such annotated corpora can be used in systems for narrative understanding and generation. The tags in the annotation scheme are in turn tied to an ontology of abstract concepts pertinent to narrative. The ontology is presented informally, while the annotation scheme is described in terms of an Extensible Markup Language (XML) Document Type Definition (DTD).

NarrativeML is a fairly 'lightweight' annotation scheme, to make it relatively easy to annotate by humans. It has been applied to the narratological aspects of examples discussed in this book, and as such is a pedagogical device to illustrate ideas in this book. However, it is also of practical import, to the extent that many of the distinctions in NarrativeML are built upon other annotation schemes (discussed below) that have been evaluated in the context of application by humans and machines to much larger corpora.

Before diving into details, I should point out that this book is guided by a vision for the future. I have written it because I believe that computational narratology has the potential to revolutionalize the way we create and study literature. For example, specialized literary search engines could find snippets of text illustrating a particular type of dialogue or plot. In interacting with the audience, improved reading and visualization environments could be developed, with checklists of narratological concepts as book discussion points. Mining of vast narrative repositories can provide much richer and larger-scale hypothesis testing and data exploration. This book will have served its purpose if it stimulates fresh thinking about these and other possibilities.

Let me get back to the basics. By **narrative**, I mean the everyday pre-theoretic use of the term, namely its dictionary sense as a count noun: "a spoken or written account of connected events; a story," from the Oxford English Dictionary (OED). As for *story*, the OED has four senses:

i) "an account of imaginary or real people and events told for entertainment;"

ii) "a report of an item of news in a newspaper, magazine, or broadcast;"

iii) "an account of past events in someone's life or in the development of something;"

iv) "the commercial prospects or circumstances of a particular company."

A narrative can thus mean senses (i) to (iii) of *story*. It can be viewed as a form of *discourse* (in the linguistic sense of a self-contained body of text that contains one or more sentences) that involves storytelling. Dialogues of everyday life studied in the field of *discourse analysis* can include narratives, and so can histories, diaries, blogs, traditional letters, emails, instant messages, travelogues, news, political speeches, scriptures, sermons, and scientific works, including popular science and descriptions of experiments. Storytelling can also, of course, produce more obviously literary material. Such stories can be expressed in poems or prose, and fictional works in particular can be expressed as epics, dramatic works, short stories, novels, etc.

What does not count as a narrative is equally important, from a linguistic annotation standpoint. An utterance such as a greeting may or may not tell a serious tale. A mention of an event (such as a bombing, love affair or war) may not count as a narrative unless it is further expanded either through elucidating its causes and/or effects, or elaborating a description of it. The classic example of Forster (1956) for what counts and does not count as a fictional story applies here: "The king died and then the queen died" is not a narrative, whereas "The king died and the queen died of grief" is. "He told me a story" is not a narrative unless it were further expanded, as in "He told me a story about a king who died and a queen who then died of grief." The six-word short story "For sale: Baby shoes – never worn" (attributed, perhaps apocryphally, to Hemingway) is often cited as a forerunner of today's 'flash fiction', and should certainly be considered a narrative. *Three Wise Men of Gotham* (the four-line verse) is also a narrative, while the six-line nursery rhymes *Mary Morey* and *Jack a Nory* probably aren't narratives. In short, a narrative must bottom-out (or drill-down) into more than one event, and these events must be connected to each other. In a conversation, only a sequence of utterances that constitutes such a coherent whole will be deemed a narrative. In a story or novel, on the other hand, the entire work is by definition a narrative. For more discussion, see Ryan (2007).

The literary scholars Scholes and Kellogg (1996) have characterized the earliest non-dramatic narratives as being epics, which involve oral retellings of a traditional story. Over time, epic gives rise to two varieties of narrative:

1. Empirical narratives that involve allegiance to reality, emphasizing truth (i.e., what really happened, and what most likely caused something). These include histories, biographies, autobiographies, and character sketches (such as those by the Greek Theophrastus in the 4th century BCE);

2. Fictional narratives that involve allegiance to an ideal, emphasizing aesthetic notions such as beauty and moral ones such as goodness. These include romances and didactic works such as satires, fables, anecdotes, allegories, and hagiographies (e.g., the 4th century BCE partially fictionalized biography of the Persian Emperor Cyrus, the Greek *Cyropedia*).

These two strains come together, Scholes and Kellogg (1996) argue, in early Latin novels, such as *The Golden Ass* (2nd century), and culminate eventually in the modern novel with all its different experimental forms. Although such a historical account might have to be revised substantially to take into account the much vaster literatures of non-Western cultures, not to mention the need to factor in the evolution of poetry, drama, the short story, and the impact of new media, it does give an idea of the breadth of various genres of literary narrative that narratology has to contend with.

I consider **Narrative Structure** to be the structure of narratives in different media. By structure, I mean representations of different phenomena that are relevant to making sense of narrative as story: these aspects include embedded narratives, time, plot, point-of-view, discourse coherence, etc. These representations typically span entire texts rather than individual sentences, and form part of what linguists broadly consider to be pragmatics.

Here, for the cognoscenti, a brief digression is required. Formalisms such as Coherence Relations (Hobbs, 1990), Discourse Representation Theory (DRT) (Kamp, 1984, Kamp and Reyle, 1993, Bos, 2008), Segmented Discourse Representation Theory (SDRT) (Asher and Lascarides, 2003) and Rhetorical Structure Theory (RST) (Mann and Thompson, 1988, Marcu et al., 1999, Marcu, 2000), are relevant to the segmentation of narrative discourse, but they illuminate other aspects of structure than the ones I am focused on here. For example, both RST and Coherence Relations focus on relations between clauses like Contrast or Parallelism, Elaboration, and Evidence; while they illuminate various aesthetic aspects of narrative, these do not say very much about plot, time, or point-of-view.[1] DRT is concerned primarily with reference; while reference is discussed in this chapter, the details of the semantic representations used in DRT are outside the scope of

[1] However, RST also addresses the relationship between models of speakers and hearers as intentional agents, on one hand, and their utterances, on the other; this will be discussed in passing in Chapter 2.

this book (see Mani et al. (2005) for an introduction).[2] As for the discourse-level theories of *story grammars*, e.g., Rumelhart (1977), van Dijk (1979), these are certainly relevant to plot and will be discussed in Chapter 4.

When speaking of narrative structure, the primary structural analysis is of the forms found in text, where **text** is a sequence of characters (i.e., written symbols) in a written work. However, there is a natural extension to forms found in oral storytelling, and storytelling across **media**, which I intend broadly to include literature, dance, film, theater, puppetry, animation, games, etc.[3] The focus on structural aspects of narrative is in itself insufficient for developing a complete theory of narrative, since structures arise in the course of storytelling from environments where agents interact with each other, involving interleaved processes of generation and understanding. Nevertheless, structure covers many of the crucial aspects of narrative that can be represented in computational terms.

Stated plainly, an agent called a **narrator** narrates a narrative to an **audience**, consisting of one or more readers, listeners, or spectators. The act of narration is an event, and a particular kind of speech act. The narrative itself can be expressed in various media, e.g., told verbally, recited, sung, danced, acted, played out, etc. Here it is useful, especially for computation, to make the traditional narratological distinction between the underlying content of a narrative and its expression. **Story** is the content of a narrative, namely, "the chain of events (actions, happenings), plus what may be called the existents (characters, items of setting)," and **discourse** is the narrative's expression, "the means by which the content is communicated" (Chatman, 1980, p. 19). This distinction has been given different names in the course of narratological history: **histoire** versus **discours** in the French structuralism of Genette (1980), and **fabula** versus **sjuzhet** in the Russian formalism of Shklovsky (1973), where *fabula* is the "raw materials of the story" and *sjuzhet* is "the narrative as told or written – incorporat[ing] the procedures, emphases, and thematic devices of the literary text" (Martin, 1986, pp. 107-108). (In later structuralists such as Bal (1997), the notion of fabula is stricter, so that all versions of a given story, e.g., *Cinderella*, will share the same fabula.)

This structuralist sense of *story* is also consistent with non-structuralist approaches, such as Forster's *story*, which is "a narrative of events arranged in their time-sequence" (Forster, 1956, p. 86). Story is thus a sense (v), distinct from the four everyday senses of *story* in the OED. To avoid ambiguity, I will use the term *fabula* instead of *story*, except where it is obvious that the narratological sense of the latter is intended (cf. *story time* below). Instead of using the term *sjuzhet*, I will use the term **discourse**, since that term is used in practically the same way in narratology and in linguistics.

Developers of intelligent narrative systems have to be cognizant of these distinctions. In story generation, the fabula is usually, but not always, instantiated in terms of the events of the entire narrative (with their participants, places, and times, and sometimes their causes and effects) in

[2] Likewise, while the relation of *Narration* is used in SDRT, and a broader sense of Narration is discussed in great detail in this chapter as well as in passing in Chapter 3, delving into SDRT presupposes providing an account of DRT.

[3] My inclusion of drama is in contrast to some literary accounts that treat drama as different from narrative on the (flimsy) grounds that it lacks a storyteller. I do not include music, as its narrative status is somewhat problematic. While poetry is within the scope of narrative structure, it is far too specialized a genre to address here.

chronological and causal order prior to any verbalization thereof, with the discourse being the final generated output. Producing a fabula is usually viewed as a byproduct of planning or synthesizing a plot, while the final discourse uses text generation methods to assemble multi-sentence text. Many of the structural aspects of narratives that need to be modeled for computational purposes can be represented at the discourse level, whereas others necessarily relate to the fabula.

I would like to make it clear that there are many aspects of narrative, including the modeling of style, subtle lexical connotations, metaphor, humor, and irony that narratology does not concern itself with. Likewise, there is work in corpus linguistics on stylistic and narratological matters (looking mainly at lexical distributions), e.g., (Herman, 2005, Toolan, 2009), which will not be discussed, though it complements the computational approach developed here.

With this highly abbreviated introduction, let me now dive into some important characteristics of narrators that are essential to take into account for both interpreting and generating narrative. As we shall see in the next chapter, with a few notable exceptions, these characteristics have by and largely been ignored in intelligent narrative systems.

## 1.2 NARRATOR CHARACTERISTICS

### 1.2.1 NARRATOR IDENTITY

The narrator is by definition present in all narratives, fictional or non-fictional; her identity is the answer to the question "Who speaks?" in a narrative. If my friend is telling me (the audience) a story in my presence, or over the phone, or by email, she is clearly the narrator. The narrative in question could well be a joke or folk-tale attributed to someone else; in such a case, the narrator is not the **author** – the latter is the creator of the story.

In the case of a *first-person* narrative that is non-fictional, the narrator is identified with the author, whereas in the case of a first-person fictional (or poetic) narrative, the narrator need not be the author. Thus, when Maxim Gorky begins the second volume of his autobiography, called *My Apprenticeship*, with the words "And so my apprenticeship began," it is fair to treat "my apprenticeship" as coreferential with Gorky's apprenticeship. However, when W. G. Sebald begins his novel *Austerlitz* with "In the second half of the 1960s I traveled repeatedly from England to Belgium," the "I" is coreferential with the fictional Jacques Austerlitz, the narrator of the novel. In the case of a first-person narrative such as Joseph Conrad's *Heart of Darkness*, the overall first-person plural narrator is not identified, but the bulk of the narrative is told in the first-person by a character in the story called Marlow, who is an embedded narrator. Narratives such as the Sanskrit *Panchatantra* and *Mahabharatha*, and the Arabic *The Thousand and One Nights* are filled with characters who tell other stories, allowing for multiple levels of discourse nesting. I will say more about such embedding in due course. For the time being, it is worth bringing in a distinction here, from Genette (1980), between a **homodiegetic** narrator like Marlow, who is part of the story he tells, and a **heterodiegetic** narrator, who isn't, as in the case of the unnamed narrator of many third-person narratives.

In some narratives, the overall narrator has only a weak or covert presence. For example, Ernest Hemingway's short story *The Killers* is mainly dialogue in direct speech, and Virginia Woolf's novel

*The Waves* consists mostly of direct speech monologues by different characters. Choderlos de Laclos' *Les Liaisons Dangereuses* is a collection of letters, i.e., an epistolatory novel, preceded by a spurious 'Publisher's Note' and an 'Editor's Preface'. In other narratives, the narrator's presence may be more overt: he may comment on the characters, or the veracity of his story, or ask the reader to skip certain parts, or draw attention to himself and his narrative effort in various ways. Sometimes a narrator may repeatedly interrupt, digress, and even question the whole narrating endeavor, as in the case of the over-intrusive narrator of Laurence Sterne's *The Life and Opinions of Tristram Shandy, Gentleman*. All these degrees of exposure can often help the author in her narratological goals, and in Sterne's case, the digressions are central to the whole satirical nature of the work.

In narrative understanding systems that map from text input to internal representations such as a fabula, the narrator is defined as above, namely as the answer to the question "Who speaks?." In narrative generation systems that take in a fabula and output coherent text, with or without audience interaction, the narrator is the system, or a specific component of it, such as the *Teller* component of Montfort (2011).

### 1.2.2 NARRATIVE DISTANCE

A narrator can vary the **narrative distance** (a term from Genette (1980)) between herself and the characters, using different forms of speech to invoke the 'speech' of other narrators. This notion goes back to Plato, who distinguished between *simple narration* or **diegesis** and *imitation* or **mimesis**, from Plato (1871). Diegesis corresponds to what is informally called *telling*, whereas mimesis corresponds to *showing*. In diegesis, the poet is the only speaker and his expression relies on indirect speech, as in Example 1.1, which is Plato's (prose) paraphrase of a fragment from Homer's *Iliad* (from Plato (1871) (III)):

**Example 1.1** The priest came and prayed the gods on behalf of the Greeks that they might capture Troy and return safely home, but begged that they would give him back his daughter, and take the ransom which he brought, and respect the God. Thus he spoke, and the other Greeks revered the priest and assented. But Agamemnon was wroth,...

The mimetic version involves direct speech, where the narrator 'takes on' the role of a character in the story, imitating him. As shown in Example 1.2 in the corresponding passage from the *Iliad* (in the poetic translation by Fitzgerald (1975)), here the narrator first imitates Khryses, and then the soldiers (ibid., p. 12):

**Example 1.2**

> This priest, Khryses, had come down to the ships
> with gifts, no end of ransom for his daughter;
> on a golden staff he carried the god's white bands
> and sued for grace from the men of all Akhaia,

the two Atredai most of all:
"O captains
Menelaos and Agamemnon, and you other
Akhaians under arms!
The gods who hold Olympos, may they grant you
plunder of Priam's town and a fair wind home,
but let me have my daughter back for ransom
as you revere Apollo, son of Zeus!"
Then all the soldiers murmured their assent:
"Behave well to the priest. And take the ransom!"
But Agamemnon would not. It went against his desire,
…

As can be seen, mimesis can often occur in the company of diegesis, as direct and indirect speech can be mixed. Based on the approach of Genette (1980), and the revised account of Genette (1988), we can distinguish three points on the distance continuum:

i) **narrated speech**: "I informed my mother of my decision to marry Albertine" or "I decided to marry Albertine;"

ii) **indirect style transposed speech**: "I thought/told my mother that I absolutely had to marry Albertine" or (free indirect style transposed speech) "I went to find my mother: it was absolutely necessary that I marry Albertine;"

iii) What we might call *quotation*; here there are three variants:

   a) **reported speech**: "I thought/said to my mother: it is absolutely necessary that I marry Albertine.;"

   b) **direct speech**: "I thought/said to my mother: It is absolutely necessary that I marry Albertine.;"

   c) **immediate speech** or **interior monologue**: "(Narrator:) It is absolutely necessary that I marry Albertine."

Cases (i) and (ii) narrate events or opinions rather than quote actual words verbatim, which differentiates them from (iii).

### 1.2.3 NARRATOR PERSPECTIVE

A narrator's perspective, or point-of-view, is also a crucial aspect of narrative. It is the answer to the question "Who sees?." A narrator may take the point-of-view of a particular character for part or all of the narrative, or she may be ominscient, 'seeing' into the mind of one or more characters. **Focalization** is the term used by Genette (1980) to represent perspective, based on the distinctions offered by Todorov (1981) and others. Genette proposes three mutually exclusive and exhaustive cases:

1. In a **non-focalized** (or **zero-focalized**) narrative, the narrator is omniscient, knowing more than any of the characters, and saying more than any of the characters. The narrator has maximal access to the mind and spatial and temporal perspective of any of the characters; for example, he can correctly predict what will happen to them. Examples are ubiquitous, including the novels of Jane Austen.

2. In an **internally-focalized** narrative, the narrator sticks to what a given character knows. The idea here is that the narrator can't see more than the character does, while having complete access to the mental states of the character. In this case, the narrator expresses the point-of-view of a given character (called the **focalizer**), either a single one for the entire narrative, or varying within the narrative between one character and another, as in the case of Hemingway's *The Short Happy Life of Francis Macomber*.

3. In an **externally-focalized** narrative, "the narrator says less than the character knows" (Genette, 1980, p. 189), a characteristic of 'behavioristic' narrative – such as Hemingway's *The Killers*. Here the narrator does not see into the characters' minds, or describe matters from their viewpoint; he pretends to be a non-judgmental witness.

There can be deviations from this scheme; for example, in an internally-focalized narrative, the focalizer may provide less information about a character than is necessary; this is called **paralipsis**.[4] Further, a focalizer may provide too much information, which Genette calls **paralepsis**.

However, focalization is not as simple as the above definitions suggest. As Edmiston (1991) points out, a first-person narrator *N* who writes retrospectively about his younger 'experiencing' self could be viewed as internally-focalized because he is limiting himself to the point-of-view of that younger person; yet *N* not only knows more, but usually says more, expressing zero-focalization; finally, *N* can also act merely as a witness when describing other characters, thus expressing external focalization. In short, these three cases need not be mutually exclusive. A good example of all three focalizations is seen in Example 1.3, an excerpt from Frank O'Connor's autobiographical story, *The Genius*:

**Example 1.3** Now one of the things I wanted badly to know was where babies came from, but this was something that no one seemed to be able to explain to me.

[4] Genette extends the use of the term in classical rhetoric, where *paralipsis* means "the device of giving emphasis by professing to say little or nothing of a subject, as in 'not to mention their unpaid debts of several millions'." (OED).

## 1.3 NARRATIVE LEVELS

### 1.3.1 EMBEDDED NARRATIVES

Let us now return to the issue of embedded narratives. A story $Y$ nested inside story $X$ can be viewed as being at a higher *level* than story $X$. Genette (1980, p. 228) defines this more precisely: "Any event a narrative recounts is at a diegetic level immediately higher than the level at which the narrating act producing this narrative is placed." The outermost level he calls *extradiegetic*, the first embedded level *diegetic* or *intradiegetic*, the second level as *metadiegetic*, the third level as *metametadiegetic*, and so on. This nomenclature is awkward, and we are better off counting levels, starting with the outermost level as level zero, so that if story $X$ is at level $n$, a story $Y$ nested inside it will be at level $n + 1$.

Perhaps the most celebrated example of embedding is found in *The Thousand and One Nights* (TTaON). Many of the stories in TTaON contain multiple other stories. For example, Scheherazade's story *The Tale of the King, his Son, his Concubine, and the Seven Viziers* has an embedded story *The Lady and Five Suitors*, and her story *The Three Ladies of Baghdad* features the eldest of the three ladies (Amina by name) telling a story about a young man. The latter case, discussed in Ryan (1991), can be represented as in Example 1.4, where $X$ is the unknown author of TTaON:[5]

**Example 1.4**

$[_{\text{level=0 narrator=X title=TTaON}}$

$\quad [_{\text{level=1 narrator=Scheherazade title=TLoB}}$

$\qquad [_{\text{level=2 narrator=Amina}}$

$\qquad\quad [_{\text{level=3 narrator=The Young Man}} \;]]]]$

From a computational standpoint, the problem of parsing a text into different narrative levels is similar in some respects to the problem of discourse segmentation, as in Marcu (2000) or Wallace (2012). As part and parcel of carrying out such segmentation, features such as narrative distance, named entities and coreference will have to be computed. These features are indicated by my italics and indentation in Example 1.5 from the TTaON:

**Example 1.5**

*The eldest of them* advanced, and thus related *her* story:-

The Story Of *The First Of The Three Ladies Of Baghdad*

*He* thus addressed *me*:-

Know that *this city* belonged to *my* father.

[5] The compendium of stories that constitutes TTaON has no single author, and has evolved considerably over the centuries.

Such a tree-based representation suffices for modeling the discourse-level effects of embedding. This assumes that there can only be one embedding 'parent' for every embedded story. In principle, of course, two narratives $X$ and $Y$ could embed a common third narrative $Z$. For example, narrative $X$ could embed a popular $Z$ tale and then narrative $Y$ could have a character repeat that tale, either through narrating the entire $Z$ (copying it verbatim), or else by reference, using a sentence like "She then repeated to the Sultan the story of the Fox and the Grapes." I will treat any repeating of Z by narrative $Y$ as a distinct story $Z$, irrespective of whether it is copied or referenced.

In Julio Cortazar's short story *The Continuity of Parks*, the third-person narrator describes a character (call him $A$) reading a novel $X$ involving a character $B$ who eventually sneaks up on $A$ to kill him. This transgressive change of narrative levels is called **metalepsis** by Genette (ibid.).[6] In this instance, a character from the embedded environment has crept into the embedding story. As for the fabula representation, it will be complicated by metalepses and entities that can belong within and across sub-narratives to different fictional worlds (more on that later).

While discussing such complications, it is worth noting that a narrator may sometimes be deemed **unreliable**, a term first discussed by Booth (1983). In Agatha Christie's *The Murder of Roger Ackroyd*, narrated by the character James Sheppard, the detective Poirot reconstructs the sequence of events involving the murder, revealing that Sheppard is the killer. The last chapter of Sheppard's narrative is both a confession and a suicide note, indicating that he had hoped that his book would have revealed Poirot's failure in solving the case, rather than his success. And in Ron Howard's film *A Beautiful Mind*, several of the key scenes and characters the audience witnesses are later revealed to be hallucinations on the part of the principal protagonist (the character John Nash), changing their fictional status. Thus, from a narratological standpoint, the audience must initially be led to believe that the character Charles Herman (a literature student) has an independent existence, albeit in a fictional world, outside the beliefs of Nash, whereas eventually the audience must revise that belief about his ontological status; the same is true of the character Parcher. Unreliable narration can thus be a trigger for *belief revision*. I will provide a somewhat more formal account of the structure of these beliefs when modeling worlds in Section 1.6. It is worthwhile noting that the revision in this case involves the reader realizing that the narrator was presenting a focalized view (from Nash's perspective) without cuing the viewer about it.

### 1.3.2 NARRATIVE THREADS

It is not uncommon to find multiple narratives that weave in and out of each other without one being entirely embedded in the other. Again, discourse segmentation methods are highly relevant, as shown in work by Byron Wallace (2012) to distentangle different narrative threads in the novel *Infinite Jest* by David Foster Wallace. Byron Wallace analyzes the novel as involving three intersecting

[6] Genette again diverges from the terminology of classical rhetoric, where *metalepsis* means a metonymy involving a double substitution, e.g.,"ears of corn" Quinn (1982).

narrative threads. He cites the following entangled passage involving the thread AFR (the tale of the Wheelchair Assassins) and the thread ETA (the tale of the Enfield Tennis Academy):[7]

**Example 1.6**

<AFR>Marathe was charged with this operation's details ...
<ETA>A direct assault upon the Academy of Tennis itself was impossible.
A.F.R.s fear nothing in this hemisphere except tall and steep hillsides.
... </ETA></AFR>

### 1.3.3 SUBORDINATED DISCOURSE

Speech acts of narration, whether embedded or not, as well as mental events such as dreams, memories, imaginings, reveries, states of believing, etc., are more generally treated as varieties of **subordinated discourse**. While embedding as discussed above involves subordination through narration, mental events introduce multiple planes of discourse. In Proust's *Jean Santeuil*, analyzed by Genette (1980), we have Jean's memories (of a past involving rainy days with his nursemaid), and his thoughts (at that past time) of the future, as shown in Example 1.7:

**Example 1.7** Sometimes passing in front of the hotel he remembered the rainy days when he used to bring his nursemaid that far, on a pilgrimage. But he remembered them without the melancholy that he then thought he would surely some day savor on feeling that he no longer loved her.

Subordinated discourses do not always involve embedded discourses per se. However, the contents of the memories and thoughts are distinct from actual happenings. They fall under what has been called *speculative language*, as discussed by Saurí and Pustejovsky (2008). When characters express beliefs, memories, etc. via subordinating contexts, the information introduced in those contexts is treated as non-factual. So, if John remembers Mary hitting Bill, that event of Mary hitting Bill will be treated as non-factual. But if John knows that Mary hit Bill, then Mary hitting Bill is factual. Thus, we must test the predicate involved in the subordinating context.

Accordingly, the discourse model will need to distinguish between factual and non-factual events; further, the scope of the subordinating event will have to be indicated. In "John believed the man was armed. He decided to hand over the money," the second sentence is outside the scope of his believing. (Scope marking will be discussed in more detail in Chapter 3.) And in Example 1.8 from Saurí and Pustejovsky (2012), events $e2$ and $e3$ are subordinated to $e1$, and are therefore hypothetical. The event participants (i.e., arguments to the event as predicate) are indicated by $x_i$. The proposition (indicated by event $e3$) that nuclear power is safe is presented as counter-factual by

[7]The machine learning approach used by Wallace (2012) automatically disentangles such threads, scoring an F-measure of 70%.

source Nelles ($x1$), and factual by Germany ($x2$), according to the narrator, whose own position is left underspecified.

**Example 1.8** Nelles$_{x1}$ said$_{e1}$ that Germany$_{x2}$ has been pretending$_{e2}$ for long that nuclear power is safe$_{e3}$.

```
factuality_profile(e3): fact(x2), non_fact(x1),
underspecified(narrator).
```

Of course, an embedded narrative may have a subordinated discourse, just like any other narrative; further, subordination can occur in factual as well as fictional narratives. From a semantic point of view, the subordinated references can be analyzed in terms of possible-world semantics using modal logic as defined by Kripke (1959). We will have more to say about this in Section 1.6.3.

## 1.4 TIME

### 1.4.1 BACKGROUND

Time is a rather abstract concept to bring to bear on a narrative. In real life, time is not directly perceived, though we can measure its passage in various ways. We experience time subjectively, with the positions of events in time changing dynamically relative to the speaker. This subjective notion gives rise to the distinctions of tense in human languages. With the past tense, the event occurs prior to the speech time; with the present, it occurs roughly at the speech time; and with the future tense, the event time is later than the speech time.

Tense is a grammaticalized expression of temporal location, and is indicated by the verb and auxiliaries in English, but also by other parts of speech, including, for a wide variety of languages, noun phrases (Comrie, 1986, Nordlinger and Sadler, 2004). Languages also vary in terms of the number of tenses. For example, the Bantu language ChiBemba has four past tenses and four future tenses. Some languages lack such grammaticalized expressions altogether, allowing time and date locutions and aspectual markers to play a greater role along with context, as in the case of Mandarin Chinese, as discussed by Lin (2003). Finally, there are languages like Burmese, which fails to distinguish past, present, and future in the absence of time and date locutions, instead using *realis* and *irrealis* particles to differentiate between ongoing or past events, and others.

Other linguistic mechanisms to express time include grammatical aspect, which represents internal phases of an event, indicating whether it is terminated or completed at a particular time (the perfective aspect, as in "We hunted yesterday"), or whether it is ongoing at the time (the imperfective aspect, e.g.,"We were hunting yesterday"). Temporal locutions expressed by adverbials, noun phrases, and prepositional phrases in English convey dates and times as well as temporal relations.

Unlike the purely mathematical abstraction of time as an infinite succession of infinitesimal instants, natural languages conceptualize time in terms of successions of events that each have a certain duration, irrespective of whether that duration is made explicit. Therefore events need to be treated as occupying finite intervals of time; a character can blink, or have lunch at noon, but in either case the author and reader are construing the event as taking time.

The linguistic devices of tense and aspect allow narrators and characters to express, from their viewpoint, the position and tempo of events in time. Narrative generation systems that vary the tense or aspect thus have to be cognizant of the way such devices operate in a given language. Narrative understanding systems also need to be aware of them in mapping from text to underlying representations such as fabulae. From the standpoint of computational narratology, it is crucial to formalize the representation of time, as discussed in Chapter 3.

### 1.4.2 NARRATIVE TIME

The time of the narrating event is known in linguistics as the **speech time**, which is distinguished from the **event time** of the events being talked about in the narrative. Thus, when someone says, "I skipped work yesterday," the event time of skipping work is one day before the speech time. A third category, of **reference time**, following Reichenbach (1947), is exemplified by expressions like "Tuesday," "the next week," etc., but can also be implicit in the text. In the sentence "The suspect had already confessed," the reference time is unspecified, and the event of confessing precedes the reference time, with both these times preceding the speech time. In Reichenbach's scheme, this ordering captures the semantics of the past perfect tense. In the simple past tense, the reference and event times coincide with and precede the speech time.

It is traditional in narratology to speak of the narrative being before, at, or after the time of narration. This gives rise to three different narrative time relations, respectively: **subsequent**, **simultaneous**, and **prior** (Genette, 1980).[8] These relations determine in turn the basic tense (past, present, and future) used by the narrator.

Returning to the distinction between fabula and discourse, an important temporal distinction is between **story time** "the duration of the purported events of the narrative" and **discourse time**, "the time it takes to peruse the discourse" (Chatman, 1980, p. 62). In computational terms, the story time of a narrative can be defined more precisely as the length of the time interval between the earliest and latest event in the narrative fabula. This may be based on predications made in the narrative as to how long particular events may have lasted, or else it may have to be derived from commonsense intuitions. The discourse time, on the other hand, can be measured in terms of the length of the recounting of the discourse of the narrative. This length can be in words in the case of text, and feet or frames of film in the case of a movie. As shown by Mani (2010a), the ratio between the two influences the pace of the narrative. Narratives use techniques such as stretching the discourse time to linger on a particular moment (as in *time-slice* or *bullet time* movies), or devoting exorbitant amounts of time to relatively inconsequential events for satirical or voyeuristic effects (as can be seen, respectively, in Voltaire's *Candide* and Robbe-Grillet's *Jealousy*), or providing speeded-up descriptions, as in James Michener's *Hawaii*, cited by Jahn (2005):

[8] Genette further distinguishes a fourth time relation of *interpolated* narration, as exemplified by epistolatory novels, but this involves a combination of simultaneous and prior narration.

**Example 1.9** The years passed. The sun swept through its majestic cycles. The moon waxed and waned, and tides rushed back and forth across the surface of the world.

### 1.4.3 NARRATIVE ORDER

Before leaving the subject of time, let me draw attention to the relation between the **order** of narration in the discourse (i.e., text order), and the order of events in the fabula. Genette (1980) identifies seven types of ordering:

1. **Achrony**: narrating events such that their order is left unclear, as in *Jealousy*;
2. **Analepsis**: flashback, i.e., narrating an event that occurred earlier than the current point in the narrative;
3. **Chronicle**: narrating events in their order of occurrence;
4. **Prolepsis**: flashforward, i.e., narrating an event in advance of the current point in the narrative;
5. **Retrograde**: narrating events in reverse order of their occurrence, as attempted in *Time's Arrow* by Martin Amis;
6. **Syllepsis**: narrating events based on an ordering that is non-temporal, e.g., spatial, as in George Perec's *Life: A User's Manual*;
7. **Zigzag:** where the narrator alternates between two times, e.g., "now" and "once," as in Example 1.7 above.

Mani (2010a) shows how these orderings can be applied to a variety of literary narratives. We shall have much more to say about ordering in Chapter 3.

## 1.5 AUDIENCE

### 1.5.1 PRELIMINARIES

All narratives are consumed by some **audience**, whether **reader**, spectator, hearer, or sets of these. In some narratives, the audience is referred to explicitly, as in invocations of "the reader" in countless non-fiction and fiction narratives. There is also the second-person "you" that refers to the audience, as in the opening sentence of J. D. Salinger's *The Catcher in the Rye*, shown in Example 1.10.

**Example 1.10** If you really want to hear about it, the first thing you'll probably want to know is where I was born, and what my lousy childhood was like and how my parents were occupied and all before they had me, and all that David Copperfield kind of crap, but I don't feel like going into it.

In other narratives, the audience may be created by the narrative, as in the case of the (somewhat depraved) Shahryar being the audience for Scheherazade's narratives.

The audience may sometimes be treated as if it is an active participant in the narrative, as in Sterne's *Tristram Shandy*: "I beg the reader will assist me here, to wheel off my uncle Toby's ordnance behind the scenes." Here the reader is being invoked through a subordinated discourse mediated by "I beg." Sometimes, the audience of an embedded story may interact with the narrator, as is often the case in Scheherazade's embedded stories. In this case, the audience is just another character or set of characters. This interaction is also found in traditional oral storytelling. In interactive narrative systems, the user/player is usually a co-author of the story, and can also be its audience, along with other, passive readers.

A reader usually develops beliefs about different characters in the story, or even of the narrator. In the latter case, we have what narratologists called the **implied author** by Booth (1983), i.e., the impression of the author created by the work, as opposed to the impression of the author created from any background information about the author. The distinction between the implied author and the narrator is far from clear, and Genette (1980) does not represent this distinction, citing in defense of Occam's Razor. For computational purposes, this is hard to model and I will ignore it. This is not to say that fine-grained distinctions are not relevant; a more detailed user model may make such a distinction, though the yardstick for it will have to be made clearer.

The **audience** in the sense in which I use the term is also called the **actual reader** in narratological studies. I do not model various finer-grained narratological notions, such as the **implied reader** of Iser (1974), the addressee or **narratee** of Prince (1982), or the **authorial audience** of Rabinowitz (1988), who accepts "the author's invitation to read in a particular socially constituted way that is shared by the author and his or her accepted reader" (ibid., p. 22). These distinctions, while insightful in themselves, are open-ended and are hard to represent in a precise and formal manner for computational purposes, and are prone to be difficult to annotate. As a result, they are left out of NarrativeML.

### 1.5.2 AUDIENCE RESPONSE

The audience does, of course, have beliefs about the narrator and characters in a work such as a novel. For example, if someone is a bank robber, the audience may assume, based on certain cultural stereotypes, that the character is likely to use the threat of violence. If someone speaks in gangster slang, the audience may believe he is a gangster. Some traits form clusters, or stereotypes, as in stock characters like the *femme fatale*. Background knowledge that may be culturally specific is often used in intelligent narrative systems that interpret narrative in a non-interactive way. From the standpoint of such systems, the audience *is* the interpreting system. While in generating narrative, interactive or not, a **user model** (or reader or audience model) is highly desirable. In every case, readers (or members of the audience) may differ in terms of their construals of the beliefs and motives of characters in the narrative.

The classic Aristotelian theory of audience response (Aristotle, 1932) is based on his notion of *pity*. In his account, dramatic tragedy works on the audience by arousing emotions of pity (sympathy) and fear (antipathy). Pity is the feeling associated with a particular type of cognitive reasoning: the person having pity feels pain toward the pitied, who does not deserve the evil which has befallen him. The audience is able to empathize with a character by imagining the same experience happening to them.

While we are discussing the audience's response, it is worth listing the many ingredients that can make a narrative seem interesting to an audience. These facets of **reader affect** include:

- *Causal connection*: are the events related to each other in plausible ways?
- *Pacing*: does the narrative move along quickly, or does it dawdle?
- *Suspense*: are expectations set up which engage the reader?
- *Resolution*: is there a worthwhile ending?
- *Characterization*: are the characters interesting, and believable?
- *Style*: does it engage and stimulate?
- *Coherence*: is it integrated into a whole?
- *Vividness*: is it immersive and memorable?
- *Morality*: does it grapple with moral issues, inspiring exemplary behavior or self-discovery?
- *Fictional reality*: does it invite you into a separate and distinct world?
- *Creativity*: does it come up with interesting and surprising new developments?

As we shall see in subsequent chapters, causality, pacing, suspense, resolution, and characterization are things that can be studied both formally and computationally. The other facets are, however, harder to model, given that many different parameters of a discourse are responsible for these audience impressions. They are left to future work on experimental evaluation of narratives.

## 1.6 FABULA

### 1.6.1 INTRODUCTION

As mentioned earlier, I will assume the definition of Chatman (1980, p. 19), where a narrative fabula is a "chain of events (actions, happenings), along with existents (characters, items of setting)." The notion of a chain presupposes both temporal as well as causal links between events. The items of setting include objects and places.

In contrast to the discourse, which is formal and highly restricted, the information in a fabula for a narrative can be immensely varied. One key notion is that of a **character** in a narrative. Characters can have **traits** (physical, moral, etc.) (these can change over the narrative) and can act, display powers, and have emotions (affect states or moods). Traits can be provided by cues in the text, e.g., one character telling another "You're a coward!," or carrying out a particular series of actions.

Traits can also be derived by association with particular social roles, as discussed in the previous section.

Before discussing more about the fabula, it is necessary to make some decisions about representation at an ontological level. Because we were talking mainly about language when discussing discourse, we got away without having to elaborate the basic view of the story world represented in a narrative. We mentioned narratives, narrators, and times, but did not link them to a more basic set of concepts that could constitute an abstract description of the world (or *upper model*). Now that we are turning to the fabula, we must represent objects, times, places, etc., but also tie events and objects more broadly to narration and narrators. I next discuss such an ontology.

### 1.6.2 BASIC ONTOLOGY

The goal of my ontology is to represent commonsense knowledge about narrative. The ontology must provide the underpinnings for the annotation scheme, so that the distinctions made in the annotation scheme have an adequate representation to support reasoning. Only a small part of commonsense knowledge will be represented, namely, the fragment most relevant to modeling narrative distinctions, even though these depend on a much larger body of commonsense knowledge of the world. Finally, this ontology is stated informally, in order to make this book both short and accessible to its intended audience; this does not, however, preclude its further formalization in a version of a Web Ontology Language (OWL).

I will assume several primitive entities for an ontology, all of them disjoint and exhaustive subclasses of the entity `thing`:

- `region`;
- `event`;
- `property`; and
- `object`.

The class `region` is divided into two disjoint subclasses: temporal `interval`, which is a 1D region, and spatial `place`, which is a 2D region (extensible to 3D). Time intervals are related to each other by temporal relations, discussed in Chapter 3.

Places are related to each other by topological relations (expressed in English by "in," "along," etc.) and orientation relations ("below," "south of," etc.). These relations can be represented in various formal calculi, as discussed in Mani and Pustejovsky (2012).

Properties are varied and include abstract ones such as a narrator – or gun – being `AT` a particular place, or an object having a particular color, such as `RED`. A property (such as a narrator being `AT` a particular place) can `HOLD` over a time interval. And entities can be `PART` of other entities.

Varieties of `event` include `action`, `speechAct`, `perception`, and `mentalEvent` such as `remembering` or `believing`. An event has at least one `participant`, where participants are the specific entities involved in the event. Actions have a logic that is the minimum required to support plan representations (see Chapter 2): an action can have preconditions and postconditions, and can be terminated – in some cases after succeeding or failing.

Among different kinds of `object`, we include `agent` and `table`. `Person` is a kind of `agent`, and so is `narrator`, `character`, and `reader` (or audience). A `character` has properties including having a particular `trait`.[9]

### 1.6.3 WORLDS AND ACCESSIBILITY

In modal logic, the truth of propositions is qualified by notions like *possibility* and *necessity*; these notions are used to provide a semantics for natural language sentences that involve references to the knowledge of agents, such as "John knows that Mary hit Bill." The classic treatment of modality from Kripke (1959) is that an agent knows something if it is true in all situations that she deems possible; these situations are called **possible worlds**. The worlds that are possible for an agent are determined by an *accessibility* relation that defines which situations are possible for the agent given each situation the agent can be in. Thus "John knows that Mary hit Bill" is necessarily true in the actual world if and only if "Mary hit Bill" is true in all possible worlds corresponding to John's knowledge, i.e., in all possible situations that he knows about.

As noted by Halpern and Moses (1992), the limits to an agent's knowledge fall out of the properties of the accessibility relation. A reflexive accessibility relation $R$ (so that for every $x$, $R(x, x)$) means that the actual (real) world is one of the possible worlds, i.e., the agent cannot know things that are false. A transitive accessibility relation (i.e., for every $x$, $y$, $z$, $R(x, y)$ and $R(y, z)$ implies $R(x, z)$) means that the agent knows whatever she knows: she is omniscient to the extent of knowing all logical implications of everything she knows. If $R$ is both transitive (as above) and symmetric (i.e., for every $x$, $y$, $R(x, y)$ implies $R(y, x)$), then she knows what she doesn't know. The accessibility relation thus has to be constrained so as to limit the knowledge of agents to what is realistic.

Modal logic is naturally extended from representing the meaning of sentences involving references to knowledge to sentences that involve references to belief, imagination, memory, obligation, future and past, etc. Thus the proposition "Jean remembered that he and his nurse went on a pilgrimage" is necessarily true in the actual world if and only if "he and his nurse went on a pilgrimage" is true in all possible worlds corresponding to his memories.

In applying possible world semantics to fiction, there has been some narratological discussion of the proposal of Lewis (1978) of treating any fictional proposition $P$ as a counterfactual conditional. For example, let $J$ be *Jean Santeuil* and $P$ be "Jean passed in front of the hotel." In the scheme of Lewis (1978):

**Property 1.11** The fictional proposition $P$ by the narrator in the narrative $J$ is true if and only if there is some possible world $W$ where:

i) $P$ is true in $W$,

[9] See Montfort (2011) for an ontology which shares similar elements, for use in interactive narrative generation.

ii) The facts in $J$ are true in $W$, and

iii) $W$ is closer to the actual world than every possible world $Z$ where those facts are true in $Z$ and $P$ is false in $Z$.

Ryan (1991) has adopted a variant of this idea, where the possible worlds with the facts in *Jean Santeuil* being true are *actual with respect to the text*, i.e., such a possible world is a textual actual world (TAW), namely, the representation proposed by the text. In more detail, Ryan assumes there is one *real* world, in which you, I, and the author of a book live, called the Actual World, or AW. In a factual narrative, a narrator speaks about this actual world; thus mentions of people, places, etc., are of entities in AW. In non-factual narrative (i.e., where subordinated discourse is involved), the narrator speaks about an Alternative Possible World (APW). In fictional narrative, however, the author's text relocates from AW to a new world, the TAW. "TAW is offered as the accurate image of a world TRW (Textual Reference World), which is assumed (really or in make-believe) to exist independently of TAW" (ibid., p. 25). From within TAW, there can be non-factual discourse that accesses other APWs.

Thus, in Ryan's account, Conan Doyle is in AW, and Sherlock Holmes is in the projected world TAW. In *The Thousand and One Nights*, there are four worlds introduced by the narrators: AW, TAW1 (where Scheherazade lives), TAW2 (where Amina lives), and TAW3 (where the young man lives). These worlds are shown (in a refinement of our earlier Example 1.4) in Example 1.12:

**Example 1.12**

$[_{\text{level=0 narrator=X world=AW title=TTaON}}$

$[_{\text{level=1 narrator=Scheherazade world=TAW1 title=TLoB}}$

$[_{\text{level=2 narrator=Amina world=TAW2}}$

$[_{\text{level=3 narrator=The Young Man world=TAW3}}\ ]]]]$

In addition, Ryan's account also calls for TRW1, TRW2, and TRW3, and any APWs introduced from either AW or one of the TAWs. This surfeit of worlds can be difficult to manage computationally and its formal basis is unclear.

Instead of proliferating worlds, one can proliferate entities (in a 'Platonic' universe), as in the **ontological promiscuity** approach of Hobbs (1985), but restrict **existence** to those entities that are actual. To say that John runs, in Hobbs's account, means that the entity of John's running exists in the actual world. When we say that John wants to fly, it will mean that John and his wanting exist in the actual world, but his flying does not exist in the actual world. Likewise, to say that Ravi worships Vishnu will mean that Ravi and his worshiping exist in the actual world, but Vishnu does not.[10]

[10]This idea is also developed substantially in the philosophy of language, most recently by Parsons (1980), who defines the concept of a set of individuating or *nuclear* properties that characterize fictional entities.

In keeping with such a promiscuous outlook, my ontology has just one world, called `World`, that has instances of all the narrative particulars mentioned above such as narrators and characters and events, all of them tied to particular times and places. As a narrative unfolds, the times in the world get updated; thus the world includes its history. For narrative understanding, the `World` is the audience's mental representation of the narrative. In the case of narrative synthesis, this corresponds to the world that underlies the narrative fabula.

Let us now consider entities and their fictional status. Any time an entity is mentioned for the first time, whether in a fictional or non-fictional narrative, whether the entity is in a subordinated discourse or not, the entity is added to the World. A coreferential mention, which does not add anything to the World merely points to the existing entity.

So, in *The Thousand and One Nights* all entities, whether they are introduced by $X$, Scheherazade, Amina, or The Young Man, are in the World, just as any entities mentioned in the memories of Scheherazade or those of any other narrators or characters. However, every entity in a narrative has both an `exists` flag and an **accessibility set**. The latter specifies which entities can 'access' that entity. Accessibility is constrained by two conventions:

i) the **embedding norm**: a character in an embedded narrative cannot access one from an embedding narrative, unless the latter is an importable character, such as generally familiar places or characters;

ii) the **knowledge norm**: if someone doesn't know of an entity, it is inaccessible to her.

Thus, while Shahryar has Scheherazade in his accessibility set, Amina does not. Likewise, any entities believed by Amina have only Amina in their accessibility set. All of these entities, being fictional, have their `exists` flag set to false. In non-fictional narrative, however, when the entity is not subordinated, or is factively subordinated (with a predicate like 'knows'), it has its exists flag set to true; otherwise, its flag is set to false.

To exemplify further, in *A Beautiful Mind*, the `World` is peopled with entities such as Nash, Charles, Alicia (whom Nash marries), Parcher, and the place Princeton. All of the people have their `exists` flag set to false; as for Princeton, assuming it is the real Princeton and not a surrogate (see Parsons (1980)), its `exists` flag is set to true. All four of these entities are accessible to Nash. When Charles is revealed to be a figment of Nash's imagination, the audience realizes that Charles was never accessible to Alicia. Thus, the World (the audience model) may have initially assumed Charles being accessible to Alicia; the revision involves deleting Alicia from Charles's accessibility set.

As another example, in *The Continuity of Parks* shown in Example 1.13 (with my elisions indicated with ...), a character $A$ reads a novel involving a character $B$ who eventually sneaks up on $A$ to kill him. $B$ is accessible to $A$, but given the embedding norm, $A$ is not accessible to $B$. So the sneaking up involves making $A$ accessible to $B$, which involves a revision of belief that violates the embedding norm.

**Example 1.13** He had begun to read the novel a few days before … Word by word, immersed in the sordid dilemma of *the hero* and heroine … now *the lover* came in … *He* went up the three porch steps and entered … The door of the salon, and then, the knife in *his* hand … the head of the man in the chair reading a novel.

Computing such accessibility relations requires determining the textual scope of intensional predicates, as well as taking into account the type of focalization.[11] In language understanding, flagging such predicates is easier when they are explicitly mentioned. Consider as an example Aesop's *The Wily Lion*, translated by Jones (1912) and shown in Example 1.14 (from Elson (2012)). Here the italicized phrases are indicative of mental state predicates; these are accessible to exactly one of the protagonists.

**Example 1.14** A Lion watched a fat Bull feeding in a meadow, and his mouth watered when he *thought of the royal feast he would make*, but he *did not dare to attack him*, for he *was afraid of his sharp horns*. *Hunger*, however, presently compelled him to do something: and as the use of force did not promise success, he *determined to resort to artifice*. Going up to the Bull in friendly fashion, he said to him, "I cannot help saying how much I admire your magnificent figure. What a fine head! What powerful shoulders and thighs! But, my dear friend, what in the world makes you wear those ugly horns? You must find them as awkward as they are unsightly. Believe me, you would do much better without them." The Bull was foolish enough *to be persuaded by this flattery to have his horns cut off*; and, having now lost his only means of defence, fell an easy prey to the Lion.

In cases involving belief revision, the computation is more complex (and may involve non-monotonic reasoning). In narrative understanding, at the very least, triggers for such revision have to be recognized. As in Example 1.13 above, an embedded character, referenced by "his," is introduced into the embedding environment; this provides the trigger.

## 1.7 NarrativeML

Based on what we have discussed so far, a basic annotation scheme can be defined in XML. The annotation scheme can be used for marking up corpora, to support narrative understanding as well as generation. We will begin with a document-level annotation scheme called **NarrativeML**, expressed as an XML Document Type Definition (DTD). Although DTD's are rather primitive, they are quite transparent, and useful for specifying the annotation scheme. Next, we will show an example of linguistic data annotated with this scheme.

[11] The problem can be viewed as similar to that of event factuality tagging of Saurí and Pustejovsky (2012).

**Example 1.15**

```
<?xml version='1.0'?>
<!DOCTYPE NarrativeML [
<!ELEMENT NarrativeML (#PCDATA | NARRATIVE)*>
<!ATTLIST NarrativeML xsi:noNamespaceSchemaLocation CDATA #IMPLIED>
<!ATTLIST NarrativeML xmlns:xsi CDATA #IMPLIED>
<!ATTLIST NarrativeML version CDATA #IMPLIED>

<!ELEMENT NARRATIVE (#PCDATA | NARRATOR | AUDIENCE | CHARACTER |
 EVENT | TIME | PLACE)*>
<!ATTLIST NARRATIVE id ID #REQUIRED>
<!ATTLIST NARRATIVE parent IDREF #IMPLIED>
<!ATTLIST NARRATIVE title CDATA #IMPLIED>
<!ATTLIST NARRATIVE level CDATA #REQUIRED>

<!ELEMENT NARRATOR (#PCDATA)>
<!ATTLIST NARRATOR id ID #REQUIRED>
<!ATTLIST NARRATOR coref IDREF #IMPLIED>
<!ATTLIST NARRATOR exists (true | false) #IMPLIED>
<!ATTLIST NARRATOR accessibleTo IDREFS #IMPLIED>
<!ATTLIST NARRATOR name CDATA #IMPLIED>
<!ATTLIST NARRATOR form CDATA #IMPLIED>
<!ATTLIST NARRATOR order (ACHRONY | ANALEPSIS | CHRONICLE |
    PROLEPSIS | RETROGRADE | SYLLEPSIS | ZIGZAG) #IMPLIED>
<!ATTLIST NARRATOR distance (NARRATED | INDIRECT |
    FREE_INDIRECT | REPORTED | DIRECT | IMMEDIATE) #IMPLIED>
<!ATTLIST NARRATOR perspective (NON_FOCALIZED |
   INTERNALLY_FOCALIZED |
   EXTERNALLY_FOCALIZED | OTHER) #IMPLIED>
 <!ATTLIST NARRATOR timeRelation (SUBSEQUENT | SIMULTANEOUS
  | PRIOR) #IMPLIED>
 <!ATTLIST NARRATOR  speechTime IDREF #IMPLIED>
 <!ATTLIST NARRATOR  person CDATA #IMPLIED>

<!ELEMENT AUDIENCE EMPTY>
<!ATTLIST AUDIENCE id ID #REQUIRED>
<!ATTLIST AUDIENCE coref IDREF #IMPLIED>
<!ATTLIST AUDIENCE name CDATA #IMPLIED>
<!ATTLIST AUDIENCE form CDATA #IMPLIED>
```

```
<!ELEMENT CHARACTER (#PCDATA)>
<!ATTLIST CHARACTER id ID #REQUIRED>
<!ATTLIST CHARACTER coref IDREF #IMPLIED>
<!ATTLIST CHARACTER exists (true | false) #IMPLIED>
<!ATTLIST CHARACTER accessibleTo IDREFS #IMPLIED>
<!ATTLIST CHARACTER name CDATA #IMPLIED>
<!ATTLIST CHARACTER form CDATA #IMPLIED>
<!ATTLIST CHARACTER attributes CDATA #IMPLIED>

<!ELEMENT EVENT (#PCDATA)>
<!ATTLIST EVENT id ID #REQUIRED>
<!ATTLIST EVENT coref IDREF #IMPLIED>
<!ATTLIST EVENT exists (true | false) #IMPLIED>
<!ATTLIST EVENT type (ACTION | SPEECHACT | PERCEPTION
  | MENTAL) #IMPLIED>

<!ELEMENT TIME (#PCDATA)>
<!ATTLIST TIME id ID #REQUIRED>
<!ATTLIST TIME coref IDREF #IMPLIED>
<!ATTLIST TIME accessibleTo IDREFS #IMPLIED>

<!ELEMENT PLACE (#PCDATA)>
<!ATTLIST PLACE id ID #REQUIRED>
<!ATTLIST PLACE coref IDREF #IMPLIED>
<!ATTLIST PLACE exists (true | false) #IMPLIED>
<!ATTLIST PLACE accessibleTo IDREFS #IMPLIED>
]>
```

Examples 1.16 and 1.17 show the opening sentence of a travel blog and its annotation in NarrativeML, respectively:[12]

**Example 1.16** March 7, 2006. Leaving San Cristobal de las Casas, I biked with Gregg and Brooks for one more day.

**Example 1.17**

```
<NarrativeML>
<NARRATIVE id ='i1' level='0'>
```

[12]This blog is drawn from a collection of travel blogs at http://www.rideforclimate.com/journals/?cat=3 that have been annotated in the motion annotation scheme ISO-Space by Mani and Pustejovsky (2012).

```
<TIME id='t1'>March 7, 2006</TIME>.
<EVENT id='e1' type='ACTION' exists='true'>Leaving</EVENT>
<PLACE id='p1' exists='true' accessibleTo='n1 c1 c2'>San Cristobal
de las Casas</PLACE>,
<NARRATOR id='n1' form='I' exists='true' order='CHRONICLE'
distance='NARRATED'
perspective='INTERNALLY_FOCALIZED' person='1sg'
timeRelation='SUBSEQUENT'
speechTime='t1'>I</NARRATOR>
<EVENT id='e2' type='ACTION' exists='true'>biked</EVENT>
with <CHARACTER id='c1' form='Gregg' exists='true'
 accessibleTo='n1 c1 c2'>Gregg</CHARACTER>
and <CHARACTER id='c2' form='Brooks' exists='true'
 accessibleTo='n1 c1 c2'>Brooks</CHARACTER>
for <TIME id='t2'>one more day</TIME>.
</NARRATIVE>
</NarrativeML>
```

NarrativeML is not intended to subsume or supplant other annotation schemes. We will assume that the predicates and arguments for each sentence are available under separate annotation based on the PropBank scheme of Palmer et al. (2005). That would make the agent initiating the leaving being the same as the one doing the biking, which will coincide in turn with the narrator. Example 1.18 shows the result of adding in the PropBank annotation.

**Example 1.18**

```
[ARGM-ADV [*1] Leaving_e1 [ARGM-LOC San Cristobal de las Casas_p1]],
 [ARG0 I_n11] biked_e2
   [ARG1-with with Gregg_c1 and Brooks_c2]
      [ARGM-TMP for one more day_t2].
```

As with the PropBank annotation scheme, we will assume that factuality profiles are part of an addition layer of annotation, external to NarrativeML. Likewise, other annotation layers such as TimeML (Pustejovsky et al., 2005), SpatialML (Mani et al., 2010), and ISO-Space (Mani and Pustejovsky, 2012) could also be added. We will investigate imports from TimeML in Chapter 3.

CHAPTER 2

# Characters as Intentional Agents

## 2.1 INTRODUCTION

### 2.1.1 PRELIMINARIES

Characters and characterization are essential to narrative. We often appreciate narratives more when the characters in them are believable or experience interesting transformations. Narratology has devoted considerable attention to characters in narratives, examining both their roles in events, the nature of their properties and traits, and readers' reactions to them. In Chapter 1, we discussed the points-of-view, existential status, and traits of characters, relating these topics to prior narratological discussion. In this chapter, we examine characters as intentional agents, i.e., as agents that have goals that they attempt to realize. Since characters can be narrators as well, the latter's goals are also of interest. Narratology has not so far paid a great deal of attention to the intentional structure of narratives at the level of agent's plans, whereas AI researchers have. The open question is whether the elucidation of such structure is relevant to humanities narratology. This chapter will point out some common areas of interest, providing an overview of AI work on planning for the narratologist, and suggesting some narratological insights on character goals and audience response for the computer scientist. This chapter will also provide a foundation for concepts of *plot* discussed in Chapter 4.

In modeling the generation and understanding of stories, researchers have striven for computational mechanisms that are generic, and that have sufficient expressive power. Planning has proved to be a generic computational mechanism. In the planning view, all characters have goals, and plans to achieve them. Every event (or state) in the narrative is viewed as being related to a character's plan. Story interpretation is viewed as plan recognition, and story generation as plan synthesis (or planning).

### 2.1.2 PLAN RECOGNITION

One of the early uses of plan recognition in story understanding was the Plan Applier Mechanism (PAM) of Wilensky (1978), which made commonsense inferences from stories using plans. Consider the micro-story in Example 2.1.

**Example 2.1** John needed money. He got a gun and walked into a liquor store. John told the owner he wanted his money. The owner gave John the money and John left.

PAM interpreted every action in a story as instantiating some goal of a character and a plan to realize that goal. In the above example, John has a goal of transferring money from an owner to himself.

His plan involves selecting some source of money and threatening its owner. This requires being near the money and getting a weapon, respectively. The owner has goals of preserving his health as well as preserving his money, which come into conflict, and are resolved in favor of the former goal. By relating actions to goals, PAM could answer questions about characters' motivations:

**Example 2.2** Why did John obtain the gun? To threaten the store owner.
Why did the owner give the money? To preserve his health (i.e., to avoid getting shot).
Why did John leave? To preserve his health (i.e., not get caught).

Such questions are valid and interesting ones from a narratological perspective. The inference of a causal connection between events, after all, goes back to the idea of *mythos* in Aristotle [1932] (to be discussed at length in Chapter 4). The fact that two thousand years later, such inferences can be automated, is certainly worthy of notice.

Whether the answers of the sort specified in Example 2.2 can be said to be correct is another matter. After all, John could have left with the idea of going to a bar. A reader may suspend judgment and leave the motives underspecified, or else there may be genuine ambiguity on the reader's part, with a preference perhaps for one motive rather than another. The bottoming-out of readers' explanations in terms of primitive motives also may vary; a particular reader may be more reductionist, appealing to biology, e.g., "That's the way men behave, they're animals!." It is safe to say that even in the case of simple stories, it is not easy for humans to infer hidden motives. Finally, none of the answers above suggests that the system understands that John is violating certain moral norms. To properly address that, the system would need rules (or *scripts*, see below) about what such norms are.

From a processing standpoint, to understand a story, plan recognition has to be incremental, so that new events can update the plan. But incremental plan recognition can also result in revision of conclusions, as in Example 2.3, which requires a degree of non-monotonic reasoning.

**Example 2.3** John needed money. He got a gun and walked into a bank. Later that day he was seen in the woods helping with the deer cull.

Recognition of plans is a hard computational problem, aside from the challenges of natural language:

- It involves non-deductive reasoning, going from observed events to conclusions (i.e., to top-level goals of characters or narrators). It has been formalized as *minimum covering entailment* by Kautz (1987), where the conclusion occurs in all covering models in which the observations are true. In terms of natural language evaluation tasks, it can be viewed as a specialized entailment task.

- It requires encoding large amounts of world knowledge even for trivial stories. It has not, as a result, flourished as much as a field in comparison with plan synthesis, which we turn to next.

### 2.1.3 PLAN SYNTHESIS

The generation of a narrative fabula can be viewed as plan synthesis, or planning, which involves finding a sequence of actions that maps from the initial state to the goal state, as defined by Riedl and Young (2010). As such, the generation of a story is similar at an abstract level to the classic AI blocks world stacking problem in Example 2.4. Here there are three blocks, and two types of events, actions such as moving one block onto another, and states such as a thing being a block, being on top of another, and being clear, i.e., with nothing on top of it. A plan, given as a proof, is also shown.

**Example 2.4**

```
Initial state:
block(A), block(B), block(C),
on(A, B), clear(A), clear(C)

Goal state:
on(B, A)

Plan:
move(A, C), move(B, A)
```

Initially, $A$ is on $B$ with nothing on top of A or C, and the plan is to have $B$ on $A$ instead. The result of the plan is that $B$ is on $A$, which is in turn on $C$.

Now, let me move from the blocks world to a more realistic world. Let us say a character called John is broke and hungry, and that the world also has a store with an edible burger. Let us say John is armed, and that he has a cat called Mia, and that there is in addition a bank conveniently at hand, in possession of money. Let us also enrich the action representation to be closer to our ontology in Chapter 1, so that actions have preconditions and postconditions. Eating satisfies an agent's hunger, but requires that the agent be hungry and possess something edible. Buying requires that the buyer have money and the seller have something, and the result is a swap. Robbing requires that the robber have a gun, and that the institution to be robbed have money; the result is that the robber gets the money. This representation of the world will have to be used by the planner to produce a fabula. The computation involves searching for an appropriate sequence of actions for getting from the initial state to the goal state, given the many facts and rules in the world.

Clearly, John being armed and the bank having money satisfies the condition for robbing the bank, as a result of which John will have money. Then the conditions for buying the burger will be satisfied, as a result of which he will buy it, which in turn will allow him to eat it. This is an example of planning using bottom-up reasoning. Alternatively, one can proceed top-down. John wants to satisfy his hunger. The action of eating can do that, provided the agent is hungry and there is something edible available. The latter can spawn a new goal, to buy something edible, for which he needs money. To get that, he can rob a bank.

The planning problem and its solution plan can be formalized as shown in Example 2.5. It can be seen that the plan incorporates both the character's mental states and goals as well as actions.

**Example 2.5**

```
Initial state:
hungry(John), bank(TheBank), store(TheStore), has(John, y), gun(y),
has(John, Mia), cat(Mia), has(TheBank, z), money(z),
not(has(John, z)), has(TheStore, The99centBurger),
edible(The99centBurger)

Goal state:
not(hungry(John))

Domain theory:
eat(x, y): pre: hungry(x), has(z, y), edible(y);
post: not(hungry(x))
buy(x, y): pre: money(z), has(x, z), has(p, y), store(p);
post: has(x, y), has(p, z)
rob(x, y): pre: has(x, z), gun(z), has(y, p), money(p);
post: has(x, p)

Plan:
rob(John, TheBank); buy(John, The99centBurger);
eat(John, The99centBurger)
```

Planning is a deductive process, which can be viewed as finding a proof for a goal given a set of initial conditions and actions. It has been formalized as propositional satisfiability (PSAT) (or constraint satisfaction), i.e., finding a model for a set of axioms, as shown by Kautz and Selman (1992). There are a variety of off-the-shelf solvers for PSAT problems. Computationally, it is an easier problem than plan recognition[1].

Examples of story fabulae planned along these lines are discussed below, in Section 2.3. For now, let us pose a more basic question. Is this sort of planning the way a human generates a narrative? After so many millennia of storytelling, the process by which stories are created still remains mysterious. Introspection by authors shows that narratives can be produced top-down, bottom-up, or even middle-out. They may emerge fully-formed, and especially so in oral narratives,

[1]To keep the discussion relatively focused, this book will not be discussing probabilistic planning, even though it is highly relevant to narrative.

but more often they are revised (and since the time of Flaubert at least, revision has been deemed virtually essential for a writer). An author may in fact change the nature of a character in the course of producing a narrative. And in the case of film, there may be numerous retakes of a particular shot, only one of which survives into the final edit. Classical AI planning does not as such capture the way a human produces or might produce a narrative; instead, it could be viewed as a posthoc explanation for how to arrive at the narrative. The question then arises as to whether that explanation provides interesting insights into narrative structure that can lead to more powerful systems or better theories.

Before answering this by discussing in more detail the modeling of goals, it is worthwhile engaging in a brief historical digression.

## 2.2 SCRIPTS AND CASE-BASED REASONING

Narratives express facets of everyday experience, especially sets of events that need to be codified and shared in some way. This suggests immediately that representing fragments of narrative in memory, at an appropriate level of abstraction, can be useful for understanding and generating narratives. This idea dates back at least to Bartlett (1932), who asked subjects to repeat a given story over time. He found that the story got reconstructed in memory according to "an active organization of past reactions, or of past experiences" (ibid., p. 201), or **schema**. The schema imposes a level of abstraction on the information in a story, favoring gists over details, and biasing the assimilation of new information toward conformity with the schema, resulting in details irrelevant to the schema being left out.

In the 1970s, AI research, particularly in the work at Yale of Schank and his team (see Schank and Abelson (1977)), gave these schemas a computational embodiment in terms of **scripts**, which are structures that represent a sequence of stereotypical events, such as eating at a restaurant. A restaurant script will involve characters typically found in a restaurant, such as waiters and patrons, and events such as arriving, perusing the menu (and perhaps other patrons), ordering, eating, paying a bill, and so forth, that may be arranged in a sequence. Characters have wants (such as food, i.e., they are hungry), and they can know that they can carry out actions (such as paying for the food). These are some of the preconditions that a script requires in order to be applicable. When a script gets 'executed', there are also postconditions that result, such as the person's hunger being satisfied. Scripts have to specify the characters, event sequences, preconditions, and postconditions.

As an example, the Script Applier Mechanism (SAM) program of Cullingford (1978) was an early story understanding system that came out of the Yale effort. It activated scripts based on the mentions, in the input story, of a script setting (e.g., a restaurant), precondition (e.g., a character being hungry), an event in the script, etc. Consider Example 2.6:

**Example 2.6** John went to a restaurant. He ordered a hot dog. The waiter said they didn't have any. He asked for a hamburger. When the hamburger came, it was burnt. He left the restaurant.

SAM was able to answer commonsense inference questions such as whether John sat down in the restaurant (probably), whether he ordered a hot dog (yes), what the waiters served him (a hamburger), and whether John paid for his food (no, because he was angry over his burnt hamburger). Scripts are also viewed as essential in resolving discourse-dependent references. Thus, given the sentence "The hamburger came," SAM would use the restaurant script along with prior discourse information to infer that it was the waiter who brought the hamburger.

When someone enters a restaurant, it sets up expectations that the person is going to eat there (unless the person is a waiter, or a hired killer). If the person pays up, one can infer that she already ate (unless she was in a place where one pays first). A person may eat with the intent of not paying. Fast-food restaurants usually do not have waiters. Given all these different scenarios, a precise definition of what should be in a script becomes problematic. Even deciding how to distinguish scripts is a problem: Schank and Abelson (1977) point out that in Example 2.7, it is unclear whether there is one script (taking a trip), two scripts (taking a trip and museum visit), or even three (bus trip, museum visit, and train trip).

**Example 2.7** John took a bus to New York. In New York he went to a museum. Then he took a train home.

In order to accommodate such variation, scripts can be organized into *tracks*. Thus, a restaurant script may have a fast food track, a cafeteria track, etc. However, the problem of a lack of specification for the set of scripts applies to tracks as well. Another strategy is to simplify scripts. Here, DeJong (1982) introduced the notion of a *sketchy script*, which focuses only on the crucial events in a script, ignoring the rest. When processing a story, the mention of a key event could invoke an Arrest sketchy script. Once triggered, the other slots in the sketchy script, such as the crime, the culprit, etc., would be skimmed for, and hopefully, found in the text. The use of sketchy scripts reduces the knowledge required in a script, and allows for easier script selection. But if salient information that isn't coded in the script is present in the input, the script won't be triggered directly.

Research in the 1970s and 80s tried to address the problems with scripts by reorganizing and simplifying them as above, but they ended up with ad hoc specifications tied to the domains of interest. Thus, it became apparent that scripts were not in fact as generic as one would like from a computational standpoint. In addition, the disadvantages of the classic Aristotelian focus on events as opposed to characters (discussed in Chapter 4) became apparent. Soon it was obvious to the Yale group and others that characters in a story and their goals also needed to be modeled.

In addition, the idea of leveraging past experience became more widespread, focusing on not simply retrieval as in scripts, but generalization through adaptation of previous examples. **Case-Based Reasoning** (CBR), which involves retrieving and generalizing fragments of narratives that have been stored in memory, is another generic computational mechanism (for an introduction, see Kolodner (1993)). CBR involves comparison with stored memories of previously similar situations to solve a problem, and has been used effectively for legal and analogical reasoning. Systems to understand and especially, generate narrative have thus availed of CBR, combining it with planning formalisms.

The idea of stories having their origins in previous fragments that are modified anew is not just germane to AI systems, but forms the basis for the improvisation found in human storytelling, as shown in studies of oral epics by Lord (1960) and Finnegan (1977). The nature of the retrieval and generalization as used in CBR can be of considerable interest to corpus-based studies, for example, in finding characters across narratives who experience common predicaments that are addressed in different ways.

## 2.3 GOALS IN PLAN SYNTHESIS

### 2.3.1 CHARACTER GOALS

To generate a fabula as a plan, one must create characters with an initial state and a goal state. The planner uses a built-in domain theory to find a plan to get a sequence of actions to get to the goal state. The initial state, goals, and the trace of the actions carried out in the plan constitute the story fabula. Obviously, any narrative generation system has to be precise about what goes into the fabula. That is in itself an important contribution to narratology, given that narratological discussion has not specified fabulae in terms of the detailed propositions involved.

One of the classic story planning systems is TALE-SPIN, developed by Meehan (1976). To start the system off, the characters and geographical locations in the story world are initialized, and each character is given a goal to solve. Each goal spawns further subgoals involving specific actions. As the actions are carried out, the state of the world is updated. The story generated is essentially a trace of the goals and actions of the characters. An example TALE-SPIN story (with my elisions indicated by ...) is shown in Example 2.8.

**Example 2.8** George was very thirsty. George wanted to get near some water. George walked from his patch of ground across the meadow through the valley to a river bank. George fell into the water. ... Wilma wanted George to get near the meadow. Wilma wanted to get near George. Wilma grabbed George with her claw. Wilma took George from the river through the valley to the meadow.

TALE-SPIN has some rather ingenious features. The characters are altruistic, and must rescue those in danger of death; both George and Wilma know that George would drown if he stayed in the river. TALE-SPIN can include both cooperative as well as adversarial activities between characters. As pointed out by Wardrip-Fruin (2009), there is also a degree of narrative embedding. Consider the case where a third character Arthur asks George where to find honey. If George's initial state is such that he is allowed to lie, he invents a character called Ivan Bee who has honey in a beehive in a redwood tree. If Arthur trusts George somewhat, Arthur's beliefs are updated with this fictitious information. Arthur is no Scheherazade, but he has the ability to spin tales within tales.

The approach of TALE-SPIN allows for all the characters' actions to be traceable to (explicit statements of) their motives (i.e., their goals). Nevertheless, it has numerous narratological shortcomings:

- As a trace of character's goals and the actions used to solve them, TALE-SPIN's stories seem rather mechanical and lacking in many of the narrative devices we examined in Chapter 1. They resemble running commentaries, blow-by-blow accounts of what the character thought and did.

- The ordering of events, mental or other, is always a chronology, in the terminology of Genette (1980).

- There is no variation in narrative distance or perspective. Nor is there much stylistic variation, even though TALE-SPIN could generate sentences that were syntactically complex, as in the above example.

- TALE-SPIN is also notorious for getting stuck in dead-ends, its so-called mis-spun tales, as in Example 2.9.

**Example 2.9** Henry Ant was thirsty. He walked over to the river bank where his good friend Bill Bird was sitting. Henry slipped and fell in the river. He was unable to call for help. He drowned.

### 2.3.2 NARRATIVE GOALS

Planned stories need a better way to control narrative outcomes, rather than leaving the story to unravel based on the successes and failure of characters' plans. Further, there are often authorial intrusions (not only those of the extreme *Tristram Shandy* variety) that cannot be modeled in terms of character goals.

UNIVERSE, developed by Lebowitz (1985), is a system that uses narrative goals as well as character-driven goals to plan narratives. It works in the domain of soap opera, specifically *Days of Our Lives*. The system is initialized using a character creation cycle, where each character wins and loses spouses, has children, and possibly dies. Each character is given a set of traits, based on stock characters (doctor, lawyer, gangster, etc.). If UNIVERSE is given a narrative goal that calls for a couple to divorce, it will insert relationship obstacles into the narrative. A typical goal involves *churning* couples, keeping them separated by new obstacles each time the previous set is cleared up.

UNIVERSE makes use of CBR. An existing plot fragment, represented as a plan, may be used or generalized to achieve this. These fragments include typical constructs relevant to such soap-operas, such as LOVERS-FIGHT, ACCIDENT-BREAKUP, STEAL-CHILD, COLLEAGUE-AFFAIR, AVALANCHE-ACCIDENT, JOB-PROBLEM, etc. Example 2.10, from Wardrip-Fruin (2009), shows the goals of churning Liz and Neil and getting Neil and Renee together, and the resulting narrative trace (the fabula produced is prefixed by ⇒). As the narrative unfolds, Liz will be threatened, Renee will seduce Neil, and Liz will get divorced.

**Example 2.10**

```
(tell (((churn liz neil)(together renee neil))))
working on goal (CHURN LIZ NEIL)
Several plans to choose from
FORCED-MARRIAGE LOVERS-FIGHT JOB-PROBLEM
using plan FORCED-MARRIAGE

working on goal (DO-THREATEN STEPHANO LIZ ‘‘forget it’’)
using plan THREATEN
⇒ STEPHANO threatens LIZ: ‘‘forget it’’

working on goal (WORRY-ABOUT-NEIL)
using plan BE-CONCERNED
Possible candidates MARLENA JULIE DOUG ROMAN DON CHRIS KAYLA
Using MARLENA for WORRIER
⇒ MARLENA is worried about NEIL

working on goal (TOGETHER * NEIL)
Several plans to choose from SEDUCTION DRUNKEN-SNEAK-IN
SYMPATHETIC-UNION JOB-TOGETHER
using plan SEDUCTION
Possible candidates DAPHNE RENEE
Using RENEE for SEDUCER
⇒ RENEE seduces NEIL

working on goal (ELIMINATE STEPHANO)
Several plans to choose from ATTEMPTED-MURDER EXPOSE
using plan ATTEMPTED-MURDER
Using ALEX for KILLER
⇒ ALEX tries to kill STEPHANO

working on goal (DO-DIVORCE TONY LIZ)
using plan DIVORCE
⇒ LIZ and TONY got divorced

working on goal (TOGETHER LIZ NEIL)
no acceptable plans
```

UNIVERSE is creative but impractical:

- It was never fully completed, and it does not do surface text generation.
- It is tied to the domain of soap opera, and severely limited by its knowledge of previous cases in memory.
- More importantly, it is far too author-driven: no actions can occur unless they satisfy a narrative goal.

Like UNIVERSE, the system MINSTREL of Turner (1993) uses CBR to tell stories. Given a particular goal, it selects and modifies a story with a particular goal by selecting and modifying a previous plan (schema) from memory. It is tied to the domain of Arthurian legend. As an example, if the system is given the goal for a knight to kill himself, it may try to find a plan where the knight can do so by drinking a potion (Pérez y Pérez and Sharples, 2004, Wardrip-Fruin, 2009). Let us say it finds only one somewhat similar plan, where a princess drinks a potion to make herself ill. By reasoning that being killed is similar to being injured, and that injury can result in death, the goal will be altered to having the knight injure himself. As there is still no plan matching this goal, MINSTREL will try to generalize the goal to find anyone doing something for self-injury, rather than just a knight. This time, the princess schema is matched and MINSTREL chooses a scene where the knight kills himself by drinking a potion.

As with UNIVERSE, MINSTREL is limited by its knowledge of previous cases in memory, but it is able to generalize to partially overcome that limitation. It has no idea of what sort of outcomes are satisfactory; for example, a knight can adapt a plan from a dragon, killing and eating a princess.

Collectively, classic systems such as TALE-SPIN, UNIVERSE, and MINSTREL all suffer from well-known problems:

- They are brittle, with careful crafting required for each story domain.
- Knowledge acquistion for these and other systems remains a challenge.
- They also lack any model of audience satisfaction, and thus many automatically generated action sequences and narrative outcomes may be undesirable. To address this recent developments related to narrative planning include the modeling of intentionality of actions to generate more plausible fabulae by Riedl and Young (2010).

For more on these systems, see Gervás (2012).

### 2.3.3 INCORPORATING COARSE-GRAINED GOAL STRUCTURE

From the standpoint of 'lightweight' narratological annotation of corpora, representing the details of the generated plan for a fabula is in my view far too onerous to be practical. A more coarse-grained level of annotation is needed, where an entire multi-sentence discourse segment can be treated as a goal. The narratological literature can be tapped for precisely such as account, as in the work of Pavel (1982)[2]. Essentially, plans are represented as binary or ternary trees, driven by a grammar with rules

[2] I am grateful to Jan Christoph Meister for pointing me to Pavel (1982).

such as Move goal being decomposed into a *Problem* and a *Solution* as subgoals. Not every action is a *Move*: only those which bring about, directly or indirectly, another *Move*, or which end the story. In making a *Move*, a character can make use (optionally) of *Auxiliary* characters or circumstances.

Figure 2.1 shows the *Move*-grammar analysis of the liquor store story we discussed earlier in Example 2.1:

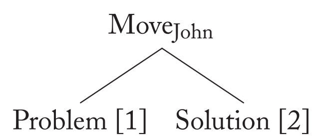


**Figure 2.1:** *Move*-grammar Analysis of *liquor store* Micro-story.

The numbered nodes in the tree in Figure 2.1 have the following labels relating to abstract concepts in the fabula:

1. John's monetary need.
2. John getting a gun and going to the liquor store to get the money.

Figure 2.2 shows the analysis by Pavel (1982) of Edgar's revenge in Shakespeare's *King Lear*.

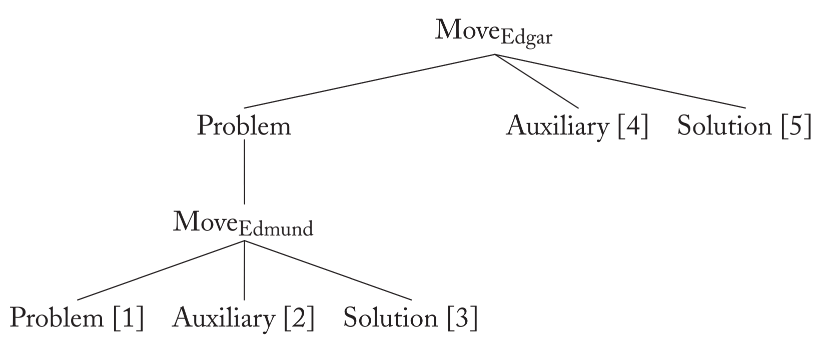


**Figure 2.2:** Pavel's *Move*-grammar Analysis of Edgar's Revenge.

The numbered nodes in the tree in Figure 2.2 have the following textual labels:

1. Edmund is the illegitimate son of Gloucester.
2. Gloucester's gullibility.
3. Edgar's banishment.
4. The killing of Oswald.
5. Victory over Edmund.

Obviously, these labels, pertaining to events in the fabula, correspond to large chunks of the play. There can be arbitrariness in the determination of these chunks and the precise tree structure. Nevertheless, these trees are substantially simpler than the more detailed plan-oriented structures we have been discussing. Implementing such trees is left to future work, but at the end of this chapter I will indicate how to represent them in NarrativeML.

While *Move*-grammars bear a superficial resemblance to what are known as *story grammars*, discussed in Chapter 4, *Move*-grammars are not, contrary to the claims of narratologists such as Cohn (1990), discourse-level grammars. They refer, as mentioned above, to the fabula. Pavel clearly means for the *Move*-grammar to relate to the events in the narrative rather than their presentation in the story. To quote Pavel (1982):

> Dolezel … distinguishes between the set of events taking place within a story and the presentation of the events in the story. He calls the former *action*, reserving the term *plot* for the latter. The *Move*-structure in the present paper represents the action of the play; (p. 32, n. 13).

He goes on to add: "a plot is a set of actions intended to overcome a certain number of *Problems*, some of which can derive from actions initiated inside the plot itself. (p. 36).

## 2.4 PLANNING FOR INTERACTIVE NARRATIVE

### 2.4.1 PRELIMINARIES

As mentioned in Chapter 1, the **audience** or **actual reader** is crucial to storytelling. The audience may be passive, as with spectators witnessing a performance or readers perusing a book; or it may be an active participant in the storytelling, as in the case of traditional call-and-response oral narratives or in interactive computational storytelling environments. In the latter case, the audience or player can shape the course and outcome of the narrative, and may take on the role of a character. An overall plan for the narrative thus has to take into account the role of such an audience. This is one of the factors that makes games with interactive narratives rather different from traditional narratives. While Murray (1997) has argued that video games, as 'cyberdrama', fall squarely within the scope of storytelling, *ludologists* such as Aarseth (1997) have emphasized such differences between games and traditional narratives, while acknowledging that there is substantial overlap between the two. It is not my purpose here to survey this debate, but two key problems are relevant from the point of view of the plans of intentional agents:

1. *Replanning*: How can the system dynamically replan the narrative given particular audience moves? Here player interactions can cause earlier plans to be revised.

2. *Outcomes*: How can the system steer an interactive narrative toward satisfactory outcomes for the audience? This is required since a player, even if he doesn't run amok, can lead a narrative toward dead-ends or unsatisfactory outcomes

### 2.4.2 REPLANNING

Here, instead of surveying the use of replanning in interactive narrative, I will focus on one particular system in some detail. I will consider the use of **reactive planning** for interactive narrative and drama in the FAÇADE system of Mateas and Stern (2005). The story world has a room with two characters, Trip and Grace (who are modeled on George and Martha in Edward Albee's *Who's Afraid of Virginia Woolf*), along with the player, who can be outside or in the room. FAÇADE relies on the reactive planning language ABL (A Behavior Language) of Mateas and Stern (2002), which is in turn derived from the *believable agent* planning language HAP of Loyall and Bates (1991).

The planning architecture consists of plan memory (all plans known to an agent) stored as production rules involving goals and their preconditions[3]. The active plan tree (involving goals active for an agent) is adjusted at runtime to remove goals that have been spontaneously achieved (this is implemented via success tests) and to remove active plans that are no longer applicable (implemented via context condition tests). This adjustment can cause a failed plan to be replaced by a new plan, if any[4].

As an example, from Mateas and Stern (2002), there are two behaviors specified for a system agent to satisfy the goal of opening a door: first, yelling for the guest to come in and waiting for them to open the door, and second, walking to the door and opening it. If both behaviors are applicable given the preconditions, the more specific one is chosen. This is shown in Example 2.11.

**Example 2.11**

```
sequential behavior OpenDoor()
 precondition
  (Knock doorID :: door)
  (Pos spriteID == door pos :: doorPos)
  (Pos spriteID == me pos :: myPos)
  (Util.computeDistance(doorPos, myPos) > 100)

 specificity 2;
// Too far to walk, yell for guest to come in
subgoal YellAndWaitForGuestToEnter(doorID);
sequential behavior OpenDoor()
 precondition
  (Knock doorID :: door)

 specificity 1;
```

[3]The left-hand side of a rule is a goal and precondition, while the right-hand side has the rule context, specificity, and plan expression. The plan expression involves parallel or sequential arrangement of steps, where each step contains a goal expression, the goal priority, and the goal success test.

[4]Choices between multiple plans are arbitrated using goal priority. Plans can also be dynamically extended, implemented by goal sensitivity.

```
// Default behavior - walk to door and open
...
```

FAÇADE's Drama Manager differentiates dramatic actions from other events in terms of the use of *beats*, where a *beat* is the smallest unit of dramatic action (not to be confused with the short pause in a dialogue). In the screenwriting prescriptions of McKee (1997), beats are used to assemble scenes. Each scene involves events that change *values* from positive to negative or vice-versa, where *value* is a significant change in certain properties of individuals and their relationships. For example, (ibid., p. 34), in a time of terrible drought, rainfall would mark a change of value (from death to life) in people's lives. In FAÇADE, each beat is chosen based on its preconditions, the player's moment-by-moment interaction, the beats so far, and an overall Freytagian dramatic arc[5]. Consider, in Example 2.12, three beat goals (from Mateas and Stern (2002)) of (i) first opening the door and greeting the player, (ii) then yelling for Grace, and (iii) finally inviting the player into the apartment:

**Example 2.12**

```
sequential behavior BeatGoals()
 with (persistent when_fails)
 bgOpenDoorAndGreetPlayer();
 with (persistent when_fails) bgYellForGrace();
 with (persistent when_fails) bgInviteIntoApt();
```

The beat goals are monitored by beat handlers. When the player refers to Grace, the beat handler for Trip ignores such references if Trip is in the middle of beat goal (ii) of yelling for Grace. Otherwise, Trip interrupts himself with "Oh, yeah," performs the beat goal (ii) within the handler, or, if that goal has already happened, says "She's coming. I don't know where she's hiding." The beat handlers are such that player interaction can cause beat goals to be interrupted, reordered, and responded to in a way dependent on what has happened in the beat so far.

FAÇADE is of narratological interest because it shows how narratives can be replanned dynamically as the audience responds. These real-time constraints have been largely ignored in narratological studies of improvisational theater. An indirect narratological contribution of Mateas and Stern (2005) is to highlight the importance of beat-based sequencing to the overall narrative arc. Although the scheme of McKee (1997) is highly informal and not entirely consistent, his account of narrative structure in films involves a series of two to five scenes forming a sequence. Sequences in turn form acts, which culminate in a climactic scene, with a story being made up of acts. The critical assessment of such screenwriting concepts for their narratological import remains to be carried out, but their relevance is apparent in FAÇADE.

FAÇADE nevertheless has a couple of salient shortcomings:

[5] Freytag's work is discussed later, in Chapter 4.

- As can be seen, a large number of specific plans have to be written to synchronize the interactions and the dialogue between characters given the presence of the player.
- Further, this sort of detailed reactive planning involves heavy scripting of the narrative that mitigates against the ability to plan more open-ended narratives.

### 2.4.3 GENERATING PREFERRED OUTCOMES

As mentioned in Chapter 1, the audience does have beliefs about the narrator and characters in the novel. In narrative understanding, the audience *is* the interpreting system. However, in generating narrative, interactive or otherwise, a **user model** (or reader or audience model) is desirable. The information in such a model needs to include how the user reacts to outcomes of particular events.

How do players or users of intelligent narrative systems respond emotionally to narratives? Models of possible user reactions can be used in an intelligent narrative system in an evaluation function to prefer choices in the narrative that will have a maximum impact at particular times on the user. This could be especially useful in pruning possible paths in a narrative generator. It can be more or less critical in interactive narrative systems, e.g., where the provision of excessive autonomy to the player can weaken authorial control and intent. Such an evaluation function could restrict user choices to those that are predicted to have particular types of impact on the user.

Unfortunately, reasoning about preferred outcomes has not been a strong suit in planning formalisms. There has, however, been some related work in interactive narrative generation. Cheong (2007) generates stories judged to be suspenseful by modeling the reader's reasoning about limitations and conflicts involving a protagonist's goals, based on psychological insights from Gerrig and Bernardo (1994) and earlier work by Cheong and Young (2006). Cheong (2007) describes a narrative generator that uses a reader model to create potentially more suspenseful stories. She manipulates two specific suspense parameters:

1. a level-of-suspense heuristic where the suspense increases as the number of planned solutions in the reader model for a particular protagonist's goal decreases (reflecting the finding from Gerrig and Bernardo (1994) that subjects report increased suspense as the number of plans available to a protagonist dwindles);
2. an (action-specific) suspense heuristic where the potential suspense for an action increases with the number of perceived obstacles (measured by the difference in the reader model between the number of effects that thwart a protagonist's goal and the number that support it).

Her system evaluation shows that these manipulations do alter the reader's suspense level.

## 2.5 EVALUATING EVENT OUTCOMES

It is undeniable that the reader's impressions about the motives and actions of an agent are formed against the background of a set of moral principles that the reader has adopted (or has been coopted to adopt). Literary critics have homed in on the role of morality in readers' interpretations;

as Rabinowitz (1988, p. 85) argues,"there can be little doubt that the process of moral evaluation plays a central role in the reading of narrative fiction." A narrative, one might argue, makes a moral case for a given agent in terms of outcomes of events he or she is involved with. This has the effect in the reader's mind of possibly boosting or casting aspersions on that agent in terms of their moral character.

In Chapter 1, I surveyed some of the prior narratological discussion of audience response. Now, to get a computational theory of audience satisfaction for outcomes off the ground, I view the reader's response in terms of a Boolean model of emotion involving judgments of sympathy or antipathy toward the agent given the outcomes of those events. For example, in *Oliver Twist*, a reader might applaud when Fagin ends up hanged, and sympathize when Oliver is rescued by a rich man. Note that the reader is evaluating the character of a particular agent such as Fagin in terms of the outcome of an event he is involved in, rather than the outcome for that agent. Thus, an outcome that is perceived as negative by an agent like Fagin may be perceived as positive by the reader, and vice versa. A measure such as the *kappa* statistic can be used to compare agreement among readers on their character evaluations while correcting for chance agreement. High agreement will lay a foundation for reliable user models of actual reader responses.

To formally model character evaluations, I begin with a representation of the narrative fabula in terms of the events, their participant roles, and their underlying chronology. This representation is implemented on a corpus of narratives with existing tools and standards. The sequence of events in narrated order is provided to the reader. Each reader rates each successive event outcome against each involved agent into exactly one of three categories: positive, negative, or neutral. Once high reliability in human character evaluations has been proven, a character evaluation tagger can be trained on these evaluations.

These evaluations are marked on events on the discourse timeline. A positive evaluation (marked $++F$) means that the reader expresses sympathy with the agent $F$ (irrespective of whether it is positive or negative for $F$), and a negative one (marked $-F$) means that she expresses antipathy toward $F$. Neutral evaluations are unmarked, unless they involve a change from positive or negative evaluations. Such a binary classification is admittedly crude, but it is a first step toward more polyvalent classifications of affect. Character evaluations are marked on the mentions of events, indicating that they are evaluations of the particular character based on the outcomes of such events.

Let us analyze character evaluations for Chekhov's story *The Lady with the Pet Dog*. Since the text is too long to include here, consider the following summary:

1. Gurov, a married man on vacation, seduced Anna, a married woman visiting Yalta.

2. Anna was ashamed that Gurov debased her. $-G$

3. When Gurov returned to Moscow, he was haunted by his memory of Anna.

4. He confronted Anna at a theater in her hometown S__, where he begged her to understand his love. $++G$

5. She confessed how much she had longed for him. ++*A*

6. They met repeatedly in secret in a hotel room in Moscow, where they contemplated the great difficulties that lay ahead. ++*G*, ++*A*

The annotations by an actual reader *R* are indicated alongside. *R* does not pass judgment on Gurov's act of seduction in part because the seduction is presented against a backdrop of scenes focalized through Gurov in a non-judgmental way so as to make the seduction entirely natural. However, once Anna's reaction is presented, *R* begins to dislike Gurov for his action. Another reader may of course have an entirely different opinion. Subsequently, when Gurov falls in love, his being haunted doesn't invoke sympathy from *R*, but the initiative he shows in seeking her out at the theatre, and her positive response, results in *R*'s enhanced appreciation for each. The ending, where they carry out their furtive affair facing the troubles that lie ahead, is tragic, making *R* sympathize with their predicament.

Character evaluations are not typically annotated on summaries, however, but on individual sentences. Further, they are applied to elements derived from a semantic representation of the sentences. As an example, if the second element above in the summary was a single sentence, here is the semantic representation we assume for it, and the associated character evaluation.

**Example 2.13**

```
[[ARG1 Anna A] was ashamed_e1
  [ARG0 that [ARG0 Gurov G] debased_e2
               [ARG1 her A]]]
e2 < e1 < t0
negative_eval(R, G, e2, 2)
```

The argument roles are annotated as in the PropBank of Palmer et al. (2005). The time $t0$ is the speech time of the second element above. The character evaluation is represented as `negative_eval(R, G, e2, 2)`, recording the fact that the reader *R*, when she read element 2, annotated the character of Gurov as negative in relation to the outcome of the event of Anna being debased.

As another example, consider a simple story that we used earlier in this chapter (in Example 2.3) to illustrate incremental plan recognition. It is shown in Example 2.14. Here '`O`' means temporal overlap.

**Example 2.14**

```
John needed_e1 money.
He got_e2 a gun and walked_e3 into a bank.
negative_eval(R, J, e3, 2)
Later that day he was seen in the woods_e4
```

```
helping_e5 with the deer cull_e6.
neutral_eval(R, J, e5, 3)
e1 < e2 < e3 < e4 < t0
e4 O e5
e5 O e6
```

During annotation, *R* does not directly see the semantic representation; the key elements are presented graphically with a menu of annotation choices. This experiment is currently underway on a corpus of fragments of literary texts, and reliability scores are not as yet available. However, similar experiment has been carried out by Elson (2012), where humans were able to reliably annotate, with high agreement, positive, negative, or neutral event outcomes for a given agent in the domain of Aesop's fables. Automatic annotation using lexical and syntactic features, however, did not perform above chance.

It is worth stressing here that my theory is obviously very crude:

- The audience may be sympathetic to a character like Oedipus, marking a positive character evaluation for him after he blinds himself; but the audience typically has a wider range of emotions than the Aristotelian dichotomy of sympathy/antipathy.

- We often hold conflicting emotions, just as we may be drawn to opposed goals from which we have to choose. To represent that, one could avail of a vector of emotions, with weights for different emotions, but that departs significantly from the goal of 'lightweight' annotation.

- Sometimes the narrator will make us self-conscious for having sympathized with a character whose current action or state makes us uncomfortable. Examples are ubiquitous, and include the final sentence of George Orwell's *1984*: "He loved Big Brother." We sympathize with Winston as a victim, but we do not approve of Winston's attitude (a point discussed at some length by Phelan (1989)). So, our sympathy must not be confused with our approval. But marking the audience's beliefs and attitudes, while essential, has not been attempted in NarrativeML.

- Authors often strive to create discomfort during endings, using devices such as irony and ambiguity. Consider the beginning of the famous last paragraph of Thomas Hardy's *Tess of the d'Urbervilles*: "'Justice' was done, and the President of the Immortals (in Aeschylean phrase) had ended his sport with Tess." When reading that sentence and the rest of the paragraph, we reflect not only on the tragedy of Tess (and Lisa-Lu and Angel) but are disturbed by the narrator's apparent throwing up of his hands to fate, though his precise attitude is left ambiguous. Marking and evaluating such narrator attitudes is left to future work based on sentiment analysis (for example, using the approach of Pang et al. (2002)).

## 2.6 NARRATOLOGICAL IMPLICATIONS

While references to characters' goals and motives are crucial for explaining the motives behind actions, modern humanities narratology has typically refrained from creating formal models of characters (or narrators) and their goals, as we have described in planning formalisms. One need not look far for justifications for this attitude. As Genette (1988, p. 136) argues, the study of characterization is not the proper province of narratology:

> In my view it is decidedly, although relatively, preferable (more "narratological") to decompose the study of "characterization" into the study of its constituting devices (which are not specific to it): denomination, description, focalization, narrative of words or thoughts or both, relation to the narrating situation, etc.

A little further on, Genette goes on to say that reader response is also outside the scope of narratology (p. 153):

> Sympathy or antipathy for a character depends essentially on the psychological or moral (or physical!) characteristics the author gives him, the behavior and speeches he attributes to him, and very little on the techniques of the narrative in which he appears.

Both these quotations are offered by Genette in defense of his focus on form, not content.

The AI perspective on characters in narrative is quite different. Formal representations of characters as intentional agents are critical for any narrative understanding system that attempts to answer questions about characters' motivations, as well as for narrative generation sytems that have to program interesting behaviors for agents. (Likewise, representing the beliefs of readers about characters, which is part and parcel of modeling audience response, is important in narrative understanding systems, and crucial for improved narrative generation and interactive narrative.) The fact that such characterization pertains to content rather than form is not an impediment to AI modeling. Nevertheless, the reasoning that goes on in the plans of characters in AI relate to the fabula, and as such are of less interest to narratology than the impact any such reasoning may have on the structure of narrative discourse. Thus, for character plans and goals to have relevance to humanities narratology, the impact of any character's plans on the discourse is an important issue.

In terms of narrative generation, this relevant part has to do with the mapping of character's goals, beliefs, and plans to their speech acts and the overall coherence structure of the discourse. Rhetorical Structure Theory (RST) as developed by Mann and Thompson (1988) for planning multisentential text, is a candidate formalism that fits the bill, when it is grounded within a theory of communication based on beliefs, goals, and speech acts, as by Cohen and Levesque (1985). Here the framework used by Hovy (1988) is highly appropriate. Hovy's overall idea is that each rhetorical relation in RST, such as elaboration, contrast, etc., between a nucleus segment and a satellite segment (both typically clauses), determines a set of constraints that have to be satisfied. Once these constraints (which reference speaker's goals and beliefs), are satisfied, a multi-clause text linking the two segments is planned, at which point the results specified in the "intended effect" part of the plan hold.

Yet, even here, the detailed representations of these plans are likely to be too fine-grained to be of interest to humanities narratology. That is one reason why the coarse-grained representation of *Move*-grammars, coming as it does out of humanities narratology, may be more relevant, provided it meets the requirements of computational narratology.

Last but not least, the use of CBR in AI, which is essentially a machine learning method, is less relevant to humanities narratology than to computational approaches that find similar patterns in memory, where 'memory' in this case corresponds to vast databases harvested from narrative corpora.

## 2.7 NarrativeML, REDUX

We are now in a position to extend NarrativeML to include character goals and evaluations (here we show just the part that is added):

**Example 2.15**

```
<?xml version='1.0'?>
<!DOCTYPE NarrativeML [
...
<!ELEMENT NARRATIVE (#PCDATA | NARRATOR | AUDIENCE | CHARACTER |
 EVENT | TIME | PLACE | GOAL | EVALUATION)*>
...
<!ATTLIST EVENT goal IDREF #IMPLIED>

<!ELEMENT GOAL EMPTY>
<!ATTLIST  GOAL id ID #REQUIRED>
<!ATTLIST GOAL parent IDREF #IMPLIED>
<!ATTLIST  GOAL  leaf (true | false) #REQUIRED>
<!ATTLIST  GOAL  type (Move | Problem | Auxiliary
  | Solution) #REQUIRED>

<!ELEMENT EVALUATION EMPTY>
<!ATTLIST  EVALUATION id ID #REQUIRED>
<!ATTLIST  EVALUATION eventID  IDREF #REQUIRED>
<!ATTLIST  EVALUATION characterID  IDREF #REQUIRED>
<!ATTLIST  EVALUATION audienceID  IDREF #REQUIRED>
<!ATTLIST  EVALUATION  value (1 | 2) #IMPLIED>
<!ATTLIST  EVALUATION  polarity (positive | negative | neutral)
  #IMPLIED>
]>
```

Example 2.16 shows the *liquor store* micro-story with the association of goals with events in the fabula. To simplify the presentation, I use a bare-bones annotation of events, leaving out irrelevant attributes, times, etc.

**Example 2.16**

```
<NarrativeML>
John <EVENT goal='1'>needed</EVENT> money.
He <EVENT goal='2'>got</EVENT> a gun and
<EVENT goal='2'>walked</EVENT> into a liquor store.
John <EVENT goal='2'>told</EVENT> the owner
he <EVENT goal='2'>wanted</EVENT> his money.
The owner <EVENT goal='2'>gave</EVENT> John the money
and John <EVENT goal='2'>left</EVENT>.
<GOAL id='0' leaf='false' type='Move'/>
<GOAL id='1' leaf='true' type='Problem' parent='0'/>
<GOAL id='2' leaf='true' type='Solution' parent='0'/>
</NarrativeML>
```

## 2.8 DISCUSSION

As we have seen in this chapter, story understanding and generation made use initially of scripts and subsequently, faced with the lack of character modeling and other limitations of scripts, incorporated plans and CBR. Plan recognition has not been very successful due to its computational hardness, while plan synthesis has been far more viable. Beginning with planned stories whose text was essentially a trace of a character's goals and her plans to realize them, the field moved on to explicit incorporation of the narrator's goals. Overall, planning focuses, and rightly so, on the mental states of characters and the motivations behind their actions, in other words, exposing the workings of intentionality in narrative. The representations used for plans, and especially the logic of actions (including pre-conditions and post-conditions), feed into some of the representations for plot that we discuss in Chapter 4. The temporal ordering that is part of that logic is in turn the basis for the work on time, as will be discussed in Chapter 3. And CBR is relevant, as a learning method, to corpus narratology.

Nevertheless, planning-based approaches have narratological limitations. Instead of using fine-grained plans, I have advocated the coarse-grained goal representation of Pavel (1982), incorporating it into NarrativeML. Obviously, using it opens up many challenges in terms of the reliability of human annotation.

Turning to interactive narrative planning, current systems allow for highly immersive environments to be experienced by a player or audience. The audience can choose outcomes, within limits.

This is, as demonstrated in the Preface, a highly active field, with a variety of narrative authoring toolkits becoming available. However, the balance between authorial and audience control remains a challenge.

Finally, computational narratology has been hampered by the lack of a theory of aesthetic satisfaction of the audience. This chapter has sketched an initial version of such a theory, adding it to NarrativeML. To be useful in designing or analyzing interactive narrative, such a theory has to be integrated with a ludological theory of play, which is left to future work.

# CHAPTER 3

# Time

## 3.1 INTRODUCTION

In Chapter 1, I provided an overview of the linguistic mechanisms for expressing time, and discussed narratological concepts such as narrative time as well as Genette's seven types of narrative ordering. In this chapter, I will first discuss the sorts of temporal problems that arise in narrative. I will then broaden the discussion to include metric (i.e., quantitative) temporal relations, and then focus on the issues that arise in trying to automatically extract such information from narratives. My focus in this chapter is on interpreting time in narrative; I have less to say about the expression of time in the course of synthesizing narratives.

This chapter will also offer more by way of evaluation metrics and results, as systems for dealing with time in language are reasonably advanced. In this regard, Section 3.5 is somewhat technical, dealing as it does with algorithms and their performance, and some narratologists may prefer to skim it first or even skip it. On the other hand, Section 3.4 is directly addressed to such readers. For more background on time in language and computation, see Mani et al. (2005).

Consider the narrative understanding task of creating a chronology of events in a narrative. For the time being, let us consider microscopic, constructed narratives. In Example 3.1, the narrative convention of simple past tense events being described in the order in which they occur is followed.

**Example 3.1** Mary stood up. John greeted her.

However, it is overridden in Example 3.2.

**Example 3.2** Yesterday, John fell and broke his leg. Mary pushed him.

Here, a language interpreting system should be able to anchor the falling event to the resolved calendar value, if any, of "yesterday," as well as order the events with respect to each other: the falling is BEFORE the breaking, and the pushing is BEFORE the falling. One might also infer that the three events occurred in quick succession.

As indicated in Chapter 1, grammatical aspect influences our ordering decisions. In Example 3.3, the perfective form indicates that the drinking was completed.

**Example 3.3** Mary entered the room. She had consumed two bottles of wine.

Whether the event is being presented as a state, i.e., stative or not, also matters. Example 3.4 has the state of being seated overlapping temporally with the event of entering.

**Example 3.4** John entered the room. Mary was seated behind the desk.

In some cases, the narrative will indicate how long particular events last. In Example 3.5, from the British National Corpus (BNC), the sales have topped 15 million over a ten-month period ending roughly at the speech time. While the announcement is anchored to a day inferable from the speech time, the length of the announcement is not specified.

**Example 3.5** Michael Jackson, whose recent world tour visited 34 countries, has announced that sales of his latest LP 'Dangerous' have topped the 15 million mark in its first ten months in the shops.

Given the many factors that can interact, inferring the underlying order of events from the discourse can be a challenge. The approaches used have included hand-constructed rules (e.g., Webber (1988), Kamp and Reyle (1993), Schilder and Habel (2001), Li et al. (2005)). Typical rules are the *narrative ordering rule* (past tense events succeed each other) and the *stative rule* (statives overlap with the event in the adjacent clause). For example, Lascarides and Asher (1993) provide both specific rules, e.g., that pushes normally cause falls, as well as general ones, such as causes preceding effects.

However, such rules are often violated. In Example 3.6, from Webber (1988), the narrative rule does not work when the buying is viewed as an extended event; in that case, the picking out is DURING the buying.

**Example 3.6** John bought Mary some flowers. He picked out three red roses.

Where is the knowledge to come from to handle a case like the latter? One could make up a rule saying that buying involves picking out items to buy, as in a Schankian script, but as we pointed out in Chapter 2, such an approach will not take us very far. The approach of Hitzeman et al. (1995) uses rules, but goes a step beyond the others by weighting them based on the knowledge sources involved, with semantic distance between utterances, computed based on lexical relationships, standing in for world knowledge. Later in this chapter, we will go even further to let the rules be learned directly from annotated corpora.

## 3.2 TEMPORAL REPRESENTATION

In the temporal representation used here, events are treated as time intervals (as are times), and time intervals are related by relations from the interval calculus (Allen, 1983, 1984), shown in Table 3.1[1].

To simplify the table, we have shown only seven of these in Table 3.1; the other six are inverse relations:

- AFTER (inverse of BEFORE);

[1] It is of course possible to further distinguish events from intervals, as done by Allen (1984), so that events can occur during an interval, either for the entire interval or for some part of it.

**Table 3.1:** Temporal Relations in the Interval Calculus

| Relation | Meaning |
|---|---|
| A BEFORE B | AAA BBB |
| A MEETS B | AAABBB |
| A BEGINS B | AAA<br>BBBB |
| A SIMULTANEOUS B | AAA<br>BBB |
| A DURING B | AAA<br>BBBBBBB |
| A ENDS B | AAA<br>BBBB |
| A OVERLAPS B | AAAA<br>BBBB |

- MET BY (inverse of MEETS);
- OVERLAPPED BY (inverse of OVERLAPS);
- BEGUN BY (inverse of BEGINS);
- CONTAINS (inverse of DURING); and
- ENDED BY (inverse of ENDS).

In narratives longer than our constructed micro-stories, only some of the events will be related explicitly by a constraint represented as one of the 13 temporal relations. Others may not be related by a single one of the 13, i.e., they will be expressible as the disjunction from among these 13 relations, e.g., the constraint 'A BEFORE B or A MEETS B'. This is not only the case for instances of achrony where the ordering of most of the events is deliberately omitted; most texts will consist of such partial orderings[2].

Table 3.2, from Mani and Pustejovsky (2012) and Derczynski and Gaizauskas (2010), shows some candidate temporal adverbials and their mapping to the interval calculus. There is no precise equivalent in English for MEETS.

Overall, given the wide variety of languages to which the interval calculus representation has been applied using TimeML (see below), there is every reason to believe that it is adequate for covering temporal relations in natural language.

[2]Note that for a *base* set of 13 temporal relations, there is a larger *underlying* set of $2^{13}$ possible disjunctions of relations, any one of which can hold between a pair of events.

**Table 3.2:** Temporal Adverbials and the Interval Calculus

| Temporal Expression | Interval Calculus |
|---|---|
| ahead of, before, in anticipation of | BEFORE |
| since then, thereafter | BEFORE |
| after, follows, previous, soon after | AFTER |
| as of | OVERLAPS, AFTER |
| during | DURING |
| starts | BEGINS |
| finishes | ENDS |
| overlaps, so far, throughout | OVERLAPS |
| while | DURING, SIMULTANEOUS |

One can view these time intervals as a primitive, as done by Allen (1983, 1984). Or else one might view them as being made up of instants, which are geometric points that are strictly infinitesimal and of zero dimension and magnitude. As mentioned in Chapter 1, our use of natural language is more in keeping with intervals, so that even blinking is viewed as taking time, albeit a short amount of time.

However, instants will be needed in my model, as without them it is not possible to represent language that describes continuous motion, as shown by Galton (1990). Further, they will be required also for efficient computation. We will thus treat both instants and intervals as primitive, as done by Galton (1990) and Pan and Hobbs (2006). In such approaches, instants begin and end intervals, and are properly within intervals, without committing to whether intervals consist of instants (thus leaving vague the meaning of 'start' and 'end'). Thus every interval $X$ will be bounded by the start instant $X_1$ and the end instant $X_2$.

As an example, consider Chekhov's story *The Lady with the Pet Dog*. The event $X$ of Gurov seducing Anna is before the event $Y$ of his confronting her at the theater. This can be expressed as a metric (quantitative) constraint: $(Y_1 - X_2) \geq 0$. Now, Gurov sees Anna off at the station in Yalta at the beginning of autumn, several weeks after first meeting her, and then visits her in the theater that very December. Thus $(Y_2 - X_2) \leq 5$ months[3].

Let us zoom in on the interval calculus itself. All the 13 relations can in fact be expressed in terms of the relation MEETS. For example, A is BEFORE B if there exists an interval C such that A MEETS C and C MEETS B[4]. The relations in the interval calculus can be composed together using a composition operator $\circ$, for example, so that if A is BEFORE B and C DURING B, A is BEFORE C. In other words, BEFORE(A, B) $\circ$ DURING(C, B) = BEFORE(A, C). Here, the

[3] A general procedure for representing numeric constraints like these in the interval calculus is found in the *Allen-to-metric* method described by Kautz and Ladkin (1991).

[4] The interval calculus has been formalized in terms of first-order logic by Allen and Hayes (1985). Based on the reduction mentioned above to MEETS, they define five axioms which specify that the meetings of intervals are unique, that pairs of intervals meet in linear order, that the union of every pair of intervals exists, and that time is infinite while intervals are finite.

composition table that defines $\circ$ has $13^2 = 169$ entries. A temporal representation for a narrative can thus be viewed as a directed graph $(V, E, \circ)$, which we call here a **temporal graph**, where $V$ is a set of nodes representing events and times, $E$ is a set of edges each of which represents a constraint $C_{ij}$ between a pair of nodes $i$ and $j$, and $\circ$ is the composition function.

Before leaving the interval calculus, an important limitation is that it does not allow for cases where time branches toward the future (or past). This might be needed for representing situations as in this excerpt from Bauling's *Ransacked Heart*, a Mills & Boon romance (from the BNC) shown in Example 3.7.

**Example 3.7** She had known their affair had to end or it would destroy them both, but now that it was about to do so, she was terrified of a future in which there would be no Luke, not even Luke causing her unhappiness.

Another instance of branching is Example 3.8, from Borges' *The Garden of Forking Paths*. Here, the speaker is Stephen Albert and the audience is his assassin Hsi P'eng.

**Example 3.8** Time is forever dividing itself toward innumerable futures and in one of them I am your enemy.

To handle such cases, one must avail of AI logics for branching time, e.g., McDermott (1982), or Computational Tree Logic (CTL), see Huth and Ryan (2004). In CTL, one can specify what can happen along paths in time, using operators (quantifiers) that specify that for some (or all) paths in time, there exists a future or past state where the proposition $P$ is true. Thus, the situation in Example 3.8 could be represented in CTL as:

```
ExistsPath[FutureState[enemy(StevenAlbert, HsiP'eng)]]
```

In summary, then, we represent all temporal relations in narrative in terms of the interval calculus, while committing to an elaboration involving instants at the end-points of intervals, and allowing for the possibility of further extension into models of branching time.

## 3.3 ANNOTATION SCHEME

We discuss here the TIMEX2 and TimeML annotation schemes, both of which have been imported into NarrativeML.

The TIMEX2 annotation scheme of Ferro et al. (2005) has been used to mark up time (and date) expressions in natural language with tags that indicate the extent and the resolved value of the time expression. A distinction is made between durative expressions, involving particular lengths of times predicated of events, and times that are treated in language as if they are points. For example, consider Example 3.9.

**Example 3.9** He finished a $[_{\text{value=PT3H, anchorTimeID=t2}}$ three-hour$_{t1}]$ meeting with the president $[_{\text{value=1999-07-15}}$ today$_{t2}]$.

Here "three-hour" is marked as a period of time (PT) while "today" is given a value, based on the reference time given by the document date. For times with fuzzy boundaries, such as "winter, TIMEX2 introduces primitives (like WI). The time zone will of course vary based on geographic longitude and geopolitical region, and TIMEX2 also factors in different calendars. TIMEX2 annotation has been carried out on corpora in Arabic, Chinese, English, French, Hindi, Italian, Korean, Persian, Portuguese, Spanish, Swedish, and Thai, with detailed annotation guidelines available for Arabic, Chinese, English, and Persian. The scheme has been applied to news, scheduling dialogs, email, blogs, and other genres.

Inter-annotator agreement is 85% F-measure on extent and 80% F-measure on time values for English in the 2004 TERN (Time Expression Recognition and Normalization) competition organized by the Automatic Content Extraction (ACE) program, which is acceptable for using the annotations to train systems. Some of the problem cases giving rise to disagreement include durative expressions where insufficient context is available. For example, in Example 3.10, from Ferro et al. (2005), the actual time of the shearing achievement is not specified, and as a result, TERN annotators differ in terms of when the 10 months of training ended.

**Example 3.10** 12-02-2000: 16 years of experience and 10 months of training are paying off for a sheep-shearer from New Zealand. Rodney Sutton broke a seven-year-old world record by shearing 839 lambs in nine hours.

TimeML, as described by Pustejovsky et al. (2005), is an annotation scheme for markup of events, times, and their temporal relations. It uses a TLINK tag to link events or times to other events or times, with the times marked up with an extension of TIMEX2[5]. Thus, Example 3.2 would be annotated as in Example 3.11.

**Example 3.11** Yesterday$_{\mathrm{t1}}$, John fell$_{\mathrm{e1}}$ and broke$_{\mathrm{e2}}$ his leg. Mary pushed$_{\mathrm{e3}}$ him.

```
[e1 BEFORE e2] [e3 BEFORE e1] [e1 DURING t1]
[e2 DURING t1] [e3 DURING t1]
```

TimeML has been applied to news, medical narratives, accident reports, fiction, etc., and a version of it has been standardized as ISO-TimeML. Corpora annotated with TimeML (called *timebanks*) have been created for a variety of languages including English, by Pustejovsky et al. (2003), Catalan, by Saurí and Badia (2012), French, by Bittar et al. (2011), German, by Spreyer and Frank (2008), Italian, by Caselli et al. (2011), Portuguese, by Costa and Branco (2012), Romanian, by Forascu et al. (2007), and Spanish, by Nieto et al. (2011).

An annotation tool used to annotate in TimeML the beginning of Garcia Marquez's *One Hundred Years of Solitude* is shown in Figure 3.1.

[5] It is worth noting that TLINKs can be given a formal semantics, as by Bunt and Overbeeke (2008).

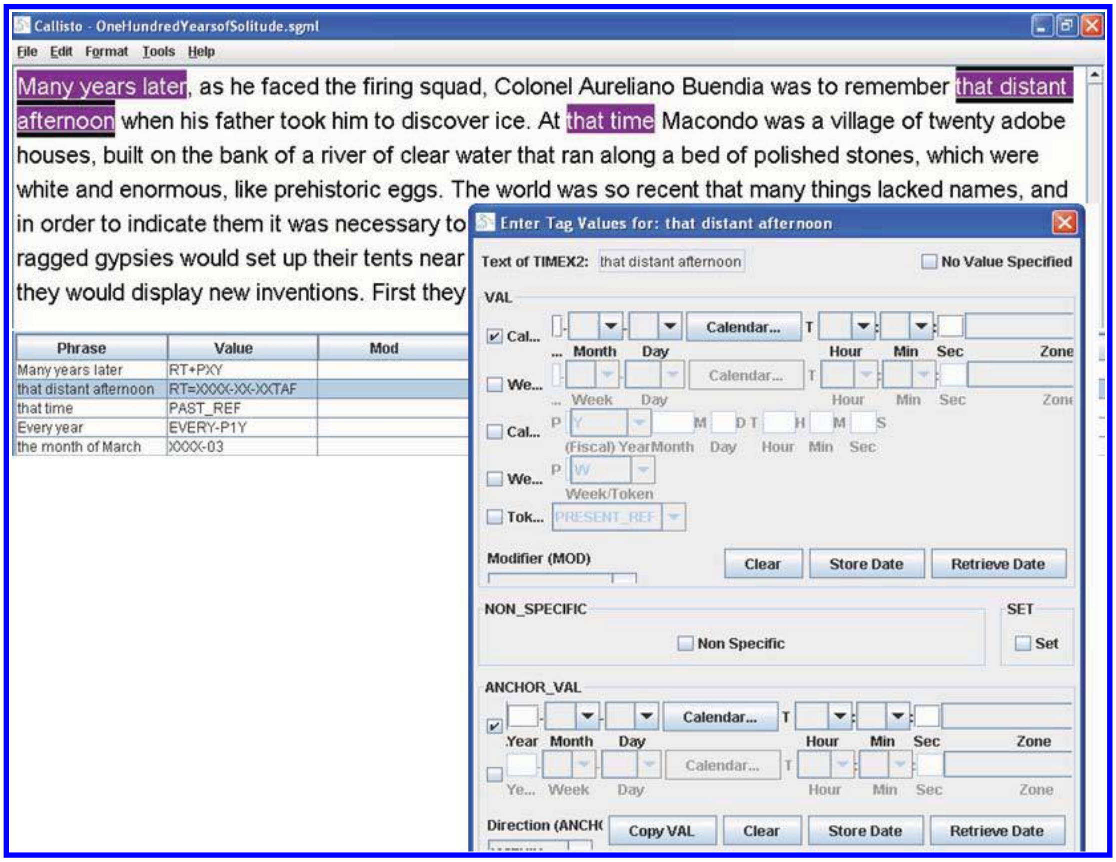


**Figure 3.1:** Annotating *One Hundred Years of Solitude*.

The highlighted time expressions are annotated in terms of their TIMEX2 markup, shown in the table as well as pop-up menus. The annotation tool also allows for the markup of events and their temporal relations. To see the associated temporal graph, let us examine more closely the famous opening sentence from *One Hundred Years of Solitude*, shown in Example 3.12.

**Example 3.12** Many years later, as he faced the firing squad, Colonel Aureliano Buendia was to remember that distant afternoon when his father took him to discover ice.

A human-annotated temporal graph for the opening sentence is shown in Figure 3.2[6]. Note that in TimeML, both events and times are treated as time intervals, and are given subscripts indicative of narration order, whereas the order of occurrence (the chronology) of the events is displayed left-to-right. In Figure 3.2, the straight arrows with triangles indicate BEFORE relations

[6]For higher resolution, the screen dump from the annotation tool has been redrawn here by hand.

(the interval at the arrow's tail being BEFORE the one at its head). The straight arrows with ovals indicate DURING relations, with the interval below being DURING the one above. The straight lines with a pair of horizontal bars indicate SIMULTANEOUS relations. As "that distant afternoon" is earlier in time than the "many years later," the computer can infer from the human annotation that Aureliano's father's taking him to discover ice (event $e3$) is BEFORE his facing of the firing squad (event $e1$). (The inferences by the computer are discussed later, in Section 3.5.4.)

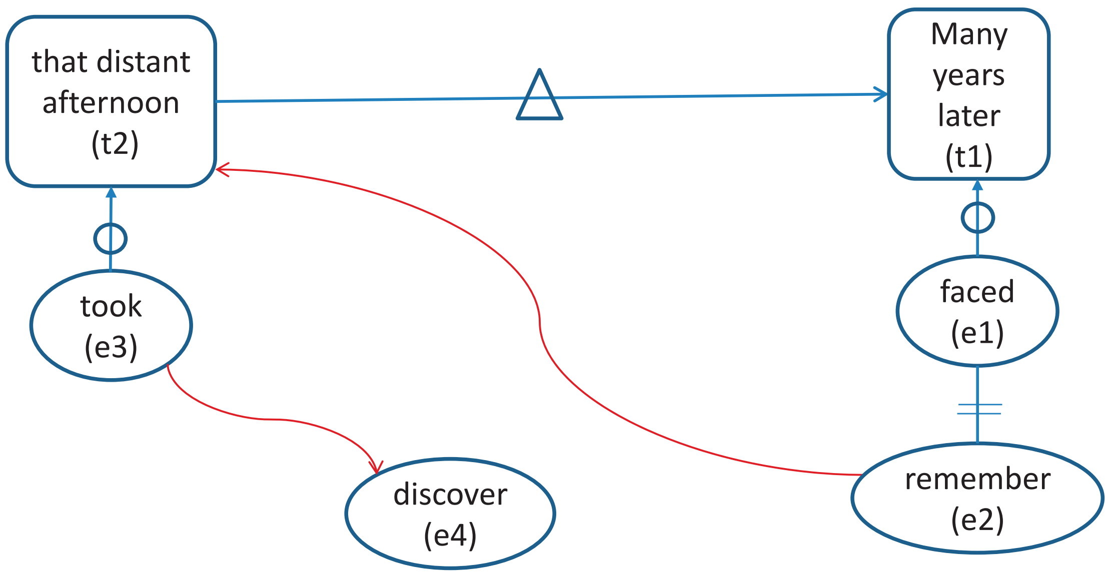


**Figure 3.2:** Temporal Graph for 1st Sentence of *One Hundred Years of Solitude*.

Is such a temporal graph a suitable representation for a narrative's temporal properties? Certainly, it represents the relation between the ordering in the fabula (indicated by TLINKs) and the ordering in the discourse (indicated by the ordering of event subscripts). All the seven orderings discussed by Genette can be expressed in this representation:

1. Achrony: events with lower subscripts are not systematically related by temporal links to those with higher subscripts.

2. Analepsis: a chain of events with subscripts $x_i$, $x_{i+1}$, and (after a possible gap) $x_{i+n}$, such that $x_{i+1}$ is BEFORE $x_i$ which is BEFORE $x_{i+n}$.

3. Chronicle: all events with lower subscripts are related by BEFORE links to those with higher subscripts.

4. Prolepsis: a chain of events with subscripts $x_i$, $x_{i+1}$, and $x_{i+n}$, such that $x_{i+1}$ is AFTER $x_{i+n}$ and $x_i$ is BEFORE $x_{i+n}$.

5. Retrograde: all events with lower subscripts are related by AFTER links to those with higher subscripts.

6. Syllepsis: there are clusters of events with contiguous subscripts where the clusters are distinguished by some non-temporal criterion, e.g., different clusters correspond to different places.

7. Zigzag: there are at least two clusters A and B of events, with events within each cluster related to each other by DURING or SIMULTANEOUS, with every event in cluster A being BEFORE any event in cluster B. The sequence of event subscripts often shows alternation between events in A and B. To examine Zigzag in more detail, let us revisit the narratologically famous sentence in *Jean Santeuil* that we encountered in Chapter 1 (Example 3.13).

   **Example 3.13** Sometimes passing in front of the hotel he remembered the rainy days when he used to bring his nursemaid that far, on a pilgrimage. But he remembered them without the melancholy that he then thought he would surely some day savor on feeling that he no longer loved her.

   Zigzag is clearly apparent in the annotation shown in Figure 3.3[7]. It can be seen that the passing is SIMULTANEOUS with the sometimes, the remembering is DURING the passing, the bringing is DURING the rainy days, the not loving is BEFORE the savoring, etc.

Currently, subordinated relations such as the relation between being taken to discover and Buendia's remembering, "remembered" and "the rainy days" and "remembered" and "then," and well as between "thought" and "some day" are all represented in TimeML by subordinating links, or SLINKs. These are shown with wavy arrows in Figures 3.2 and 3.3. Note that in Figure 3.3 the rainy days ($t2$) remembered by the narrator are not temporally related to the ones postulated by the narrator by "then" ($t3$). Such relations are not handled within the strictly linear model of time that Allen's representation confines itself to, and there one has to resort to the branching time models mentioned above.

The temporal relations being considered in our temporal graphs are more expressive than merely precedence and equality in Genettian narratology, since we allow for time intervals which are related in the seven different ways shown in Table 3.1. Discourse time itself is not directly captured, though this is a matter of detail; the indices ($e3$, etc.) might be easily extended to include a measure of offset into the narrative (a similar point is also made by Meister (2005)). Once that is added, the *story time* of a narrative (the time it occupies in the timeline) can be compared to its *discourse time*, i.e., the length of the text in terms of the time taken to read it. That, in turn, can if desired be normalized to a function of the number of words used to recount the event (e.g., using an average reading rate, such as 300 words per minute). The ratio of story time to discourse time, which Genette (1980)

[7] Here too, for higher resolution, the screen dump from the annotation tool has been redrawn by hand.

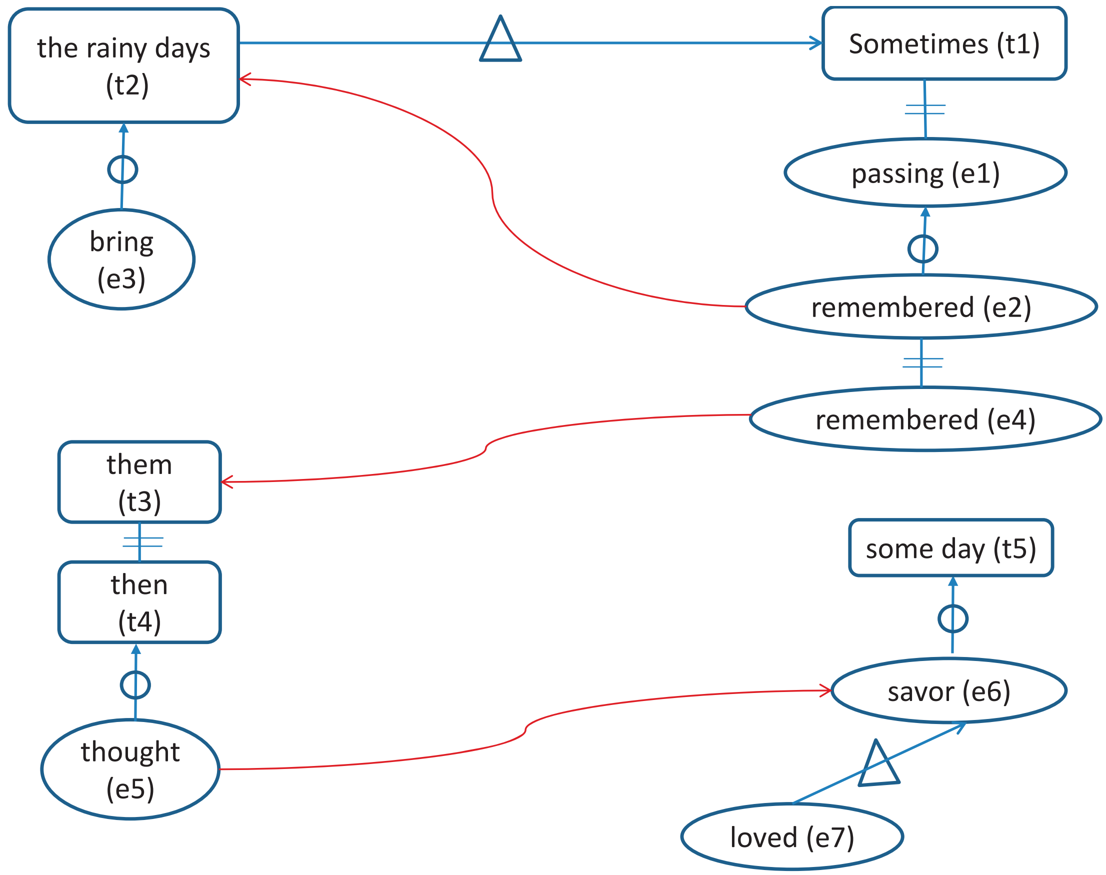


**Figure 3.3:** Zigzagging in *Jean Santeuil*.

classifies into isochronous, accelerated, and decelerated tempos, offers a computational measure of narrative pace. For a detailed treatment along these lines of temporal ordering, tempo, and other time-related phenomena in fiction, see Mani (2010a).

I pointed out that in Example 3.2, the events appear to be in quick succession. Since humans also have strong intuitions about how long particular events last (e.g., an invasion lasts longer than a sneeze), it is possible to add to the markup estimates of the minimum and maximum bounds for events, as Pan et al. (2011) have done for TimeML (so as to cover 80% of the probable scenarios given the text context). Humans tend to agree almost 90% of the time on such bounds. Further research is needed to determine more precise durations.

However, the annotation by humans of TLINKs in TimeML remains a challenge, for several reasons:

- Inter-annotator agreement for TLINKs was only 55% F-measure, as reported by Mani et al. (2006) for the English TimeBank[8]. The poor agreement is partly because the Allen temporal relations are sometimes too fine-grained for the narrative at hand; in such cases, a disjunction of relations is preferred, but the guidelines, in the interests of simplicity, rule out marking disjunctions. As a result, one annotator may leave the relation out, while another may not. One way of addressing this is to allow for degrees of granularity in the representation, as argued by Mani (2005).
- Two annotators can arrive at equivalent but different temporal relations, e.g., one might declare A BEFORE B and B BEFORE C, while the other may also include A BEFORE C. This problem can be addressed by computing the transitive closure of both graphs, and comparing those closed graphs instead of the original annotations.
- Finally, given that the number of possible links is quadratic in the number of events and times, annotators tire easily; evidence from Bethard et al. (2007) suggests that many valid potential links in the TimeBank were missed in the annotation.

Despite all these problems, there have been instances of high agreement among annotators when annotation guidelines are considerably improved. For example, work by Caselli et al. (2011) shows very high agreement between annotators in terms of deciding which events are related by a TLINK as well as what type of TLINK holds between those events (with the agreement scored at 91% and 0.88 kappa, respectively).

## 3.4 NARRATOLOGICAL IMPLICATIONS

The creation of temporal graphs for narratives makes possible new corpus-based lines of investigation that are relevant to the interests of humanities narratology. Here are some examples:

- Finding narratives whose temporal graphs illustrate a pattern. Patterns such as the Chronicle or Zigzag of Genette (1980) are already trivially computable for any TimeML-annotated corpus, as suggested by the examples in the previous section. Patterns for cases where subordinated events are involved, modeled with branching time, present an area ripe for further narratological annotation.
- Identifying changes of tempo in narratives. As shown in Chapter 1, cases where inconsequential events are dealt with at great length, or where significant events are passed over very speedily, can illustrate interesting narrative effects. They can also reveal critical inflexion points in the unfolding of the plot. As an example, consider our old friend *The Wily Lion* from Chapter 1, visualized in a chart where the horizontal axis is **discourse time** and the vertical axis represents (the ticks of) **story time**, shown in Figure 3.4, from the annotation by Elson (2012) (p. 90). Here $T1, \ldots, T16$ are successive clauses in the narrative. From $T1$ to $T7$, the lion is deliberating,

[8] Nevertheless, when a TLINK is posited by both annotators between the same pairs of events or times, the inter-annotator agreement on the labels goes up to 77% F-measure and 0.71 kappa, considered to be high agreement.

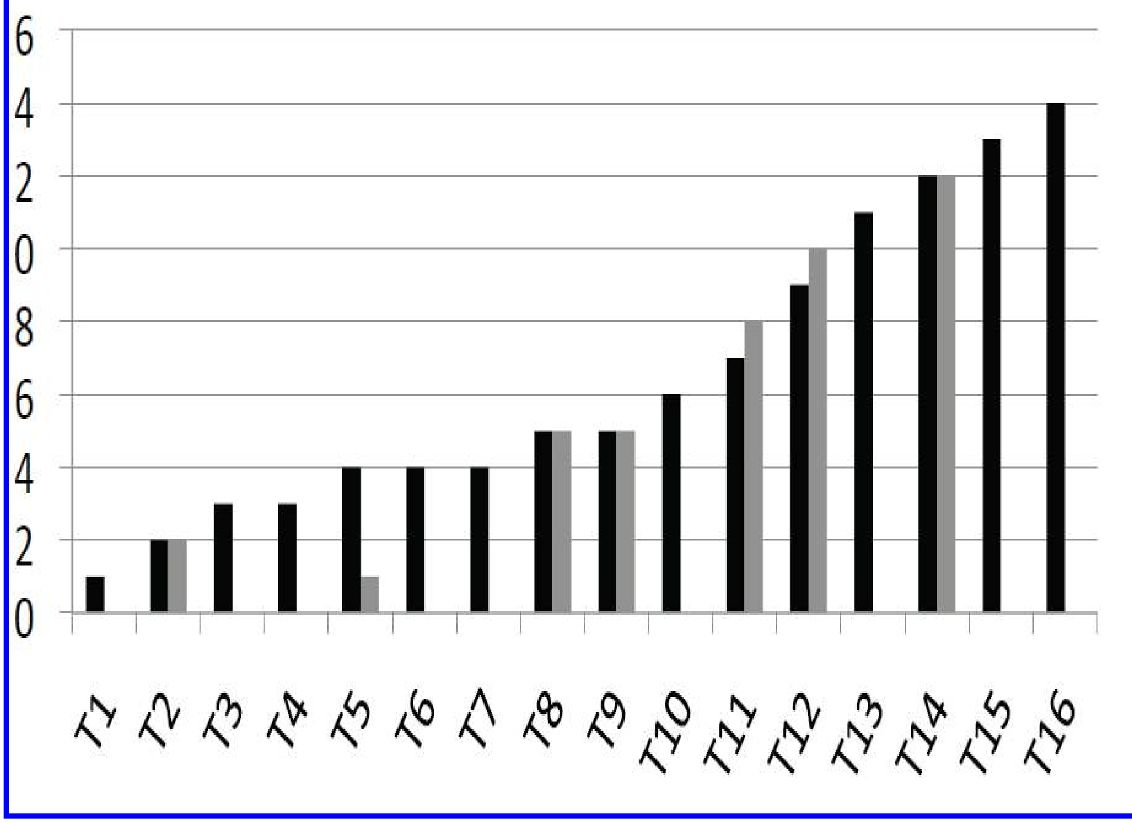


**Figure 3.4:** Discourse Time versus Story Time for *The Wily Lion*.

and the vertical bars do not rise above time tick 4. From $T8$ onward ("Going up to the Bull in friendly fashion,"), as Elson (2012) points out, he becomes a creature of action, and time moves much more swiftly in this action phase of the story, with story time rising up to 14 ticks.

- Decomposing the temporal graph to reveal key components, such as where a given character appears. Doing so not only simplifies the temporal graph, but allows for comparison of character behaviors. For example, consider the *The Travelers and the Bear* from Aesop's Fable, shown in Example 3.14. The temporal graph for it is annotated as shown in Figure 3.5, redrawn from Bethard et al. (2012) (p. 2722)[9]. Here the arrows with ovals, as before, indicate DURING relations, while the other arrows indicate BEFORE relations. The subgraph where the nimbler traveler disappears from the narrative is indicated by a dashed rectangle. In contrast, the portions of the narrative allocated to the nimbler traveler's presence are indicated by dashed teardrops. It is clear that the nimbler traveler is backgrounded, and that the other traveler not

[9]For automatic annotation of these stories, see Kolomiyets et al. (2012).

only gets more press (in keeping with his exemplary behavior), but occupies a larger contiguous stretch of the timeline.

**Example 3.14** Two Travelers were on the road together, when a Bear suddenly appeared on the scene. Before he observed them, one made for a tree at the side of the road, and climbed up into the branches and hid there. The other was not so nimble as his companion; and, as he could not escape, he threw himself on the ground and pretended to be dead. The Bear came up and sniffed all round him, but he kept perfectly still and held his breath: for they say that a bear will not touch a dead body. The Bear took him for a corpse, and went away. When the coast was clear, the Traveler in the tree came down, and asked the other what it was the Bear had whispered to him when he put his mouth to his ear. The other replied, "He told me never again to travel with a friend who deserts you at the first sign of danger."

## 3.5 AUTOMATIC APPROACHES

### 3.5.1 NATURAL LANGUAGE GENERATION

Let us briefly consider time in natural language generation, where given the fabula with its ordering, the discourse order must be computed. This is in fact a simpler problem than going from the discourse to the fabula. The system STORYBOOK of Callaway (2000) takes as input a set of propositions (who did what to whom in the Red Riding Hood domain). It has to be provided with characters, scenes and their settings, events, and a partial ordering of those events. It produces a fabula, and then plans individual sentences of the discourse and fine-tunes (i.e., revises) them, before realizing them using a sentence generator that avails of an English lexicon and grammar.

STORYBOOK does not however carry out planning to produce the fabula. It uses a finite-state machine, selecting exactly one path through a set of hand-created possibilities for sequences of events and scenes. In doing so, it enforces consistency across scenes, pruning inconsistent paths, and relying on *safe* scenes that do not clash with anything else.

In converting from fabula to discourse, STORYBOOK has parameters to specify which characters and events to focus on and what goals they have, and the roles they should play in the narrative (hero, villain, etc.). It also has parameters for the *narrator perspective* (narrator as character or disembodied narrator), the voice (first, second, or third person), etc. STORYBOOK relies very heavily on built-in defaults and user specifications for the values of these parameters.

For *Little Red Riding Hood*, the timeline STORYBOOK can generate is reasonably complex, and involves the phase of the poor girl meeting the wolf, then her going off gathering wildflowers and chasing butterflies, while the wolf rushes ahead (these two events are more or less in parallel), and then his arriving before she does. All this is carried out using an interval calculus representation. The system decides what tense to use and when to shift tense. In doing so, it reasons whether to generate dialogue or not – in dialogue, conversations may use a different tense and aspect from the embedding narrative (e.g., present versus past tense, respectively). Finally, the system plans individual sentences

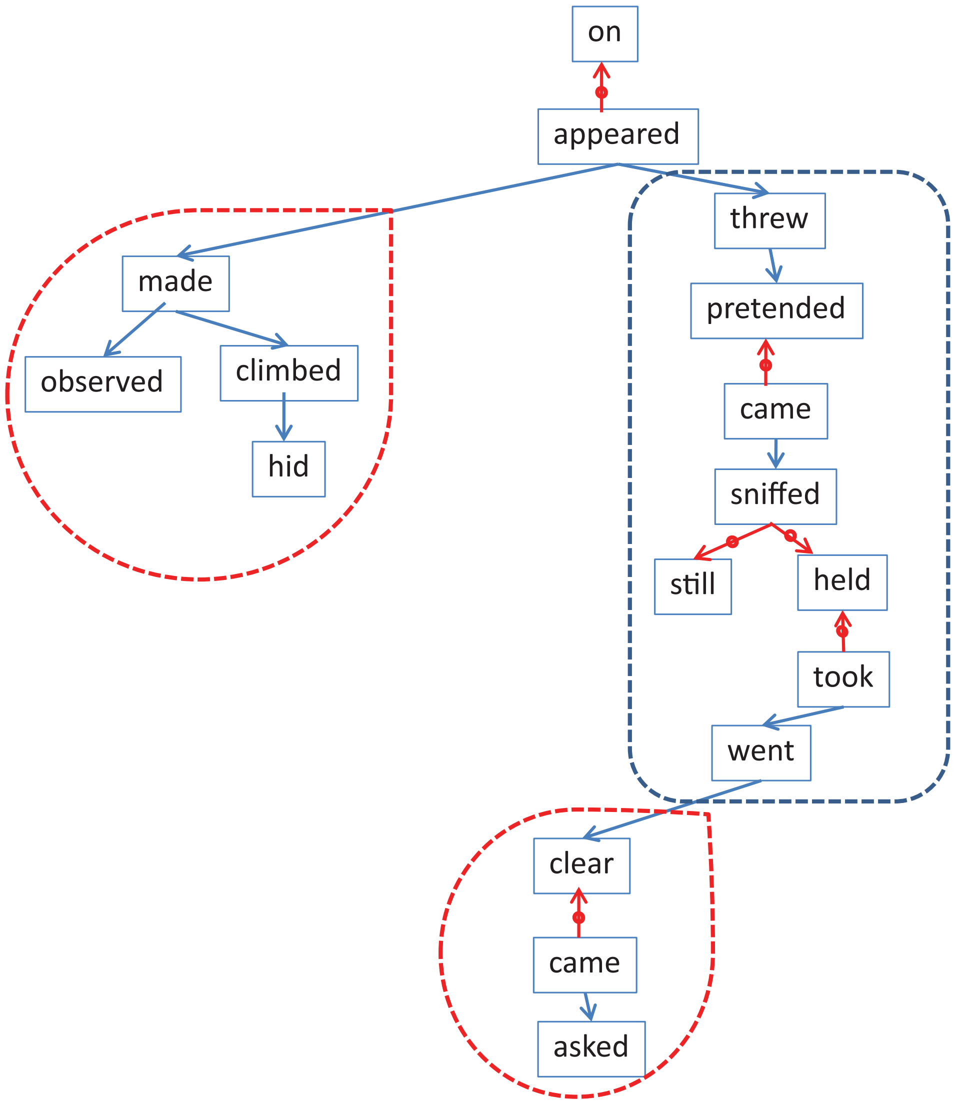


**Figure 3.5:** Temporal Graph for *The Travelers and the Bear*.

and then realizes them using a sentence realization component using a grammar and lexicon of English.

**Example 3.15** Little Red Riding Hood had not gone far when she met a wolf. "Hello," greeted the wolf, who was a cunning-looking creature. "Where are you going?" "I am going to my grandmother's house," Little Red Riding Hood replied.

However, it relies far too heavily on built-in defaults and user specifications for its system parameters. See Lönneker (2005) for a detailed critique. STORYBOOk generates output that displays a variety of fluent tense shifts, as in Example 3.15.

In contrast to the use of grammar-driven sentence realization, many systems today, especially those that generate dialogue and short text snippets, use template-driven text generation. Here, the templates map non-linguistic input directly to the linguistic output form, sacrificing linguistic generalization for rapid prototyping. Some of these templatic capabilities are impressive. Perhaps the most time-cognizant of all the generation systems is the interactive fiction system CURVESHIP of Montfort (2011). It varies the narrator's speech time and the reference time with respect to the event time, to decide on the particular tense. It also makes use of temporal adverbials and conjunctions like "then" and "before" to express temporal relations, as shown in Example 3.16.

**Example 3.16** Your senses were humming as you viewed the broad, circular, encircling Plaza of the Americas. The morning had concluded. It was midday then.

CURVESHIP implements all of Genette's seven orderings, using the following heuristics:

1. Achrony: order events at random.
2. Analepsis: select the most salient event from the first time the focalizer encountered this character, or else select the most salient events that the focalizer has seen happen in this room in the past, up to three of them.
3. Chronicle: sort events in chronological order.
4. Prolepsis: pick 'inevitable' events such as the sun going down, or nuclear missiles arriving.
5. Retrograde: sort events in reverse chronological order.
6. Syllepsis: use whenever the adventurer is entering a new area, or defeating a monster, or acquiring a treasure.
7. Zigzag: all the events in a single physical location are narrated in the "now," and then the corresponding events in the "then," and so on for each location.

What CURVESHIP does not do, however, is decide when it is most appropriate to use one type of ordering rather than another. As such, discourse-ordering choices such as these can benefit from corpus-based narratological studies.

Both the above system do not avail of TimeML but are compatible with its use and especially so given their deployment of the interval calculus.

### 3.5.2 TIME TAGGING

Let us now turn to language understanding, where the problem is to extract the underlying temporal information from narrative discourse. The first extraction task we will consider is tagging the extents of time expressions (i.e., their offsets in the text) and resolving them. Given the availability of TIMEX2-annotated corpora, the most accurate approaches to TIMEX2 extent tagging have relied on machine learning from these corpora. A typical approach is to classify each successive word in a text as being part of a TIMEX2 tag or not. The features used can include contextual features such as a window of words to the left and right, and a lexicon of time words for the language, such as weekdays, month and holiday names, date expressions, and units of time. The best learning-based systems for extent tagging in TERN (the Time Expression Recognition and Normalization competition discussed earlier in Section 3.3) have scored as high as 85.6% F-measure for English, as shown by Hacioglu et al. (2005).

For tagging time values, rule-based approaches have performed well. The top-performing system in TERN'2004, by Negri and Marseglia (2004), was a rule-based approach that obtained an F-measure of 87.2% in tagging values. Rules are especially useful for covering discourse-dependent time values. Mani and Wilson (2000) resolve expressions like "Tuesday" in "the events on Tuesday," or bare month names like "June" based on rules that classify the direction of the offset from the reference time. For example, in the following, "Thursday" is resolved to the Thursday prior to the reference date because "was" is found earlier.

**Example 3.17** The Iraqi news agency said the first shipment of 600,000 barrels was loaded Thursday by the oil tanker Edinburgh.

Recently, in Task A of the TEMPEVAL-2 competition described by Verhagen et al. (2010), a single score was used for both tagging the extent and resolving the values of time expressions. The best systems scored 91% F-measure for Spanish and 86% F-measure for English. In general, one may conclude that tagging time expressions and resolving them is a problem that is being tackled quite well.

In resolving time values, systems need to carry out calendar computations about distances in time. "A month from today" may mean the same date next month, if it exists, or 28-31 days from today. While software for reasoning with and converting between calendars is freely available, calendar arithmetic for these distance locutions in natural language remains something of a challenge. Some recent work relevant to this problem has been carried out by Han et al. (2006) and Pan and Hobbs (2006).

### 3.5.3 EVENT TAGGING

The Evita system of Saurí et al. (2005) tags TimeML events using particular morphological and syntactic patterns within a sentence (e.g., finite verbs, and event nouns). Such a system has an accuracy of about 80%. This result is to be contrasted with the 60% accuracy ceiling that has been observed in research on extracting more abstract events, such as the Message Understanding Conference competition (MUC) described in Grishman and Sundheim (1996), where one has to recognize a given news story (e.g., a failed hijacking attempt) as an instance, for example, of a terrorist event and identifying the type of event, the participants, etc. (Other tasks have included recognizing instances of corporate takeovers, money laundering, etc.) The reason for the higher accuracy for TimeML events is that these events are at the 'surface' of the text, expressed by particular morphological and syntactic patterns within a sentence for the most part (e.g., finite verbs, event nouns). The MUC events require a large number of inferences that involve, in addition, semantic and pragmatic reasoning over the entire document.

Tagging subordination relations via SLINKs, as in the case of Jean remembering the rainy days, or Aureliano Buendia remembering a distant afternoon, are in the 70% range, based on published results from the TARSQI system. Factuality profiles are tagged by Saurí and Pustejovsky (2012) at F-measures of 70% to 80%.

As for event durations, in terms of estimates of the minimum and maximum bounds for events, Pan et al. (2011) have annotated the TimeBank with commonsense durations, providing durations for 1,260 distinct events. They developed an automatic tagger trained on the TimeBank that scores 76% accuracy in determining whether an event lasted a day or longer. More fine-grained commonsense durations are yet to be computed automatically.

### 3.5.4 INFERRING TEMPORAL RELATIONS

Previous research by Mani et al. (2006) has viewed labeling of temporal relations as a statistical classification problem: given an ordered pair of elements $X$ and $Y$, where $X$ and $Y$ are events or times known to be related temporally via a TLINK, the classifier has to assign a single label from the set of TLINKs in TimeML. Using their TARSQI system, they obtained an accuracy of 59.68% for inter-event TLINKs and 82.47% for Event-Time TLINKs, when the training and test instances were not only different, but drawn from different documents in the TimeBank. In comparison, a rule-based approach with 187 rules scored 63.43% for inter-event TLINKs and 72.46% for Event-Time TLINKs.

More recently, Task C of the TEMPEVAL-2 competition of Verhagen et al. (2010) has required finding the temporal relation between an event and a time expression in the same sentence (specifically, where either the event syntactically dominates the time expression, or the event and time expression occur in the same noun phrase). The best score was an F-measure of 65% for English, and 81% for Spanish. In Task E, finding the temporal relation between two main events in consecutive sentences, the best system (only English was used) scored an F-measure of 58%.

Event ordering systems for narratives have been developed for a variety of languages, including English, Spanish, Swedish (Berglund et al., 2006), Chinese (Li et al., 2005), etc. Overall, in inter-event linking there is a ceiling effect, where accuracy scores do not rise much beyond the 70% F-measure.

Now, a key computational problem in dealing with temporal graphs is determining if the graph is free of inconsistencies, such as A BEFORE B and B BEFORE C along with the clashing constraint C BEFORE B. These inconsistences can easily arise when a human or machine annotates a narrative, as local decisions often come into conflict with global constraints. Further, cycles in time are not uncommon in narratives, as in the Cortazar story *Continuity of Parks* discussed in Chapter 1, where the narrator's reading is AFTER the past events in the embedded novel, the latest one of which (the sneaking up on the narrator) is BEFORE the reading.

The least a decent program can do is to detect such a cycle, and then decide whether it is to be preserved or not. Thus, in the case of a user doing the annotation, when the system detects a cycle in *Continuity of Parks*, the user may retain it in the annotation. But in other cases, the cycle may indicate an error in the human annotation, and so the user will have to correct that error. When the system is automatically annotating a corpus, without the user being involved, the system can mark the subgraphs that involve a detected inconsistency.

One consistency detection strategy is to verify whether every pair of nodes that are known to be consistent can be extended to a triple of nodes that are consistent. The key step in the algorithm is to compute, for all triples of nodes $i$, $j$, $k$ in the graph, the value of temporal constraint $C_{\mathrm{ij}}$ to be the old value of $C_{\mathrm{ij}}$ intersected with the composition $C_{\mathrm{ik}} \circ C_{\mathrm{kj}}$. This *path consistency* algorithm thus computes the transitive closure of the graph.

Path consistency is a necessary condition but not in general sufficient for establishing consistency; Vilain et al. (1989) found pathological inconsistencies involving quadruples of nodes that a path-consistency algorithm (such as the one in Allen (1983)) will not detect. However, one can get around such pathologies, which one may or may not run into in practice, by restricting the interval calculus severely. A restriction which uses all the 13 base relations, but only a proper subset of 10% of the underlying relations, was discovered by Nebel and Burckert (1995).

The statistical classifier for TLINKs described above in Mani et al. (2006) can produce an inconsistently annotated document. Since it merely inserts links between pairs of nodes A and B (events and/or times) in the graph (e.g., A BEFORE B), it does not take into account compositions with other nodes in the graph that have already been classified (e.g., A AFTER B via some other node C such that A AFTER C and C AFTER B). One way of addressing this problem is to use a greedy method that first ranks the test instances by classifier confidence (i.e., preference) and then applies temporal closure axioms iteratively starting with the most preferred instances (Mani et al., 2007). A more general approach is to replace the second step with a method of combining preferences using closure axioms, but with the problem of consistency framed as a global optimization problem. Integer Linear Programming (ILP) is a machine learning framework that provides a generic method for solving the global optimization problem, while allowing for declarative (rule-based) specification of closure axioms. ILP thus guarantees that any solution found will be consistent. Working on medical case history summaries from the *New England Journal of Medicine*, Bramsen et al. (2006) have developed a method that computes the temporal ordering of elements that are temporal segments corresponding to distinct time frames, each of which can contain one or more events. For example, a medical narrative might have segments on a patient's admission, a previous hospital visit, and the onset of symptoms. To infer temporal relations, their use of ILP resulted in an accuracy of 84.3%.

An alternative to ILP is the use of Markov Logic Networks, as used in Yoshikawa (2009). Here the closure constraints do not have to be all-or-nothing ones as in ILP, allowing instead for *soft* ones such as the following:

**Property 3.18** If time $t1$ is BEFORE the Document Creation Time (or $DCT$, i.e., document date) and event $e1$ OVERLAPS $DCT$, then $e1$ is AFTER $t1$.

Using Markov Logic Networks, weights for such rules can be learned from the training data. Such an approach yielded the best results on TEMPEVAL-1 data for Task A (events and times in the same sentence) as well as Task C (events in two consecutive sentences).

How well do these methods work on literary narratives? Consider Balzac's novella *Sarrasine*, which has been of interest to narratologists ever since Barthes (1975) analyzed it in structuralist-semiotic terms. The opening sentence is shown in Example 3.19.

**Example 3.19** I was buried$_{e1}$ in one of those profound reveries$_{e2}$ to which everybody, even a frivolous man, is subject in the midst of the most uproarious festivities$_{e3}$. The clock on the Elysee-Bourbon had just struck$_{e4}$ midnight$_{t1}$.

When TARSQI is run on *Sarrasine*, a number of errors are produced (John Stewart, p.c.). The results on Example 3.19 are illustrated in Figure 3.6. Here the symbols for temporal relations are the same as in Figure 3.2, except that erroneous links are indicated with shading, as seen in the two shaded BEFORE link triangle icons.

Here the state of being subject to reveries ($e2$) should be DURING the festivities ($e3$), which are both habitual events. Habituals are not, however, modeled appropriately in TimeML. The festivities ($e3$) should also not be BEFORE the clock's striking ($e4$).

Other problems noticed with *Sarrasine* are numerous instances of scene-setting descriptions, such as in Example 3.20.

**Example 3.20** The trees, being partly covered$_{e1}$ with snow$_{e2}$, were outlined$_{e3}$ indistinctly against the grayish background formed$_{e4}$ by a cloudy sky, barely whitened$_{e5}$ by the moon.

Here the temporal relations between the events should, arguably, all be OVERLAPs, but TARSQI does not treat these relations in a uniform manner.

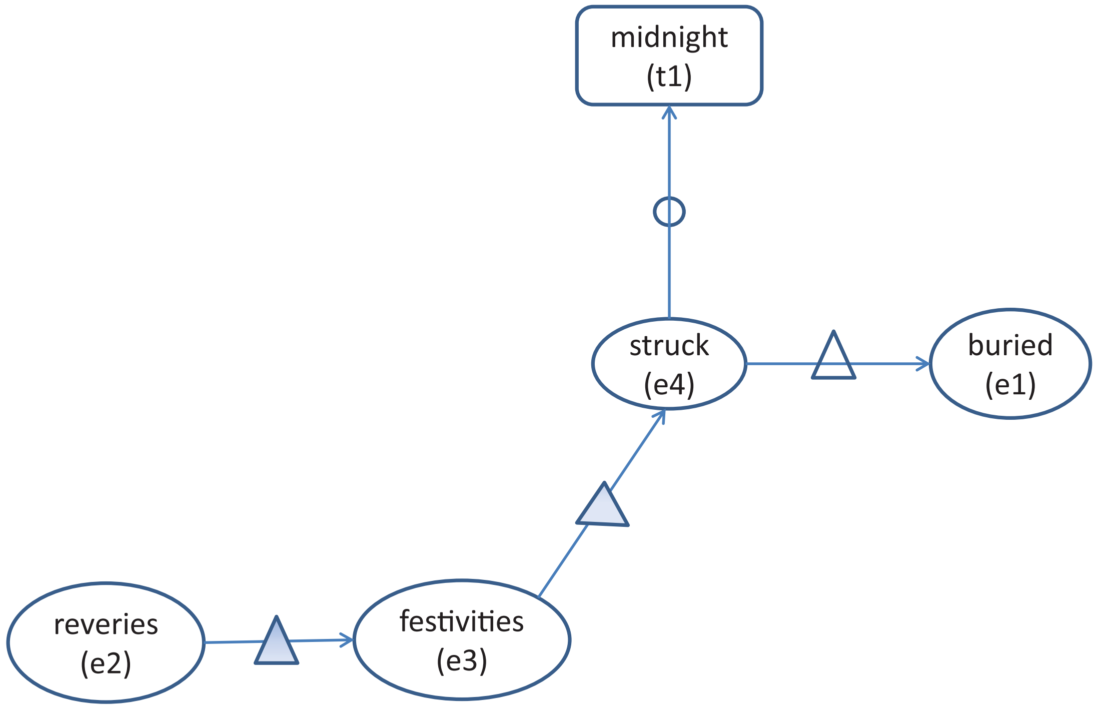


**Figure 3.6:** Errors on *Sarrasine*.

## 3.6 NarrativeML, REVISITED

We can now extend NarrativeML introduced in Chapter 1 to include temporal information, shown in Example 3.21.

**Example 3.21**

```
<?xml version='1.0'?>
<!DOCTYPE NarrativeML [
...
<!ELEMENT NARRATIVE (#PCDATA | NARRATOR | AUDIENCE | CHARACTER |
 EVENT | TIME | PLACE | TLINK | SLINK | EVALUATION | GOAL | TEMPO)*>
...
<!ATTLIST EVENT duration NMTOKEN #IMPLIED>
...
<!ATTLIST TIME value NMTOKEN #IMPLIED>
<!ATTLIST TIME beginPoint IDREF #IMPLIED>
<!ATTLIST TIME endPoint IDREF #IMPLIED>
```

```
<!ELEMENT TEMPO EMPTY>
<!ATTLIST TEMPO storyTime NMTOKEN #IMPLIED>
<!ATTLIST TEMPO readingLength NMTOKEN #IMPLIED>

<!ELEMENT TLINK EMPTY>
<!ATTLIST TLINK id ID #REQUIRED>
<!ATTLIST TLINK type (SIMULTANEOUS | BEFORE |  IMM_BEFORE | OVERLAPS
  | BEGINS | ENDS | INCLUDES) #REQUIRED>
<!ATTLIST TLINK eventID IDREF #IMPLIED>
<!ATTLIST TLINK timeID IDREF #IMPLIED>
<!ATTLIST TLINK relatedToEvent IDREF #IMPLIED>
<!ATTLIST TLINK relatedToTime IDREF #IMPLIED>

<!ELEMENT SLINK EMPTY>
<!ATTLIST SLINK id ID #REQUIRED>
<!ATTLIST SLINK eventID  IDREF #REQUIRED>
<!ATTLIST SLINK subordinatedEventID  IDREF #REQUIRED>
]>
```

Given the extensions in this chapter, the travel blog in Example 1.17 in Chapter 1 is shown in Example 3.22.

**Example 3.22**

```
<NarrativeML>
<NARRATIVE id =‘i1’ level=‘0’>
<TIME id=‘t1’>March 7, 2006</TIME>
<EVENT id=‘e1’ type=‘ACTION’ exists=‘true’
  duration=‘PT2H’>Leaving</EVENT>
<PLACE id=‘p1’  exists=‘true’ accessibleTo=‘n1 c1 c2’>San Cristobal
de las Casas</PLACE>,
<NARRATOR id=‘n1’ form=‘I’ exists=‘true’ order=‘CHRONICLE’
distance=‘NARRATED’
perspective=‘INTERNALLY_FOCALIZED’ person=‘1sg’
timeRelation=‘SUBSEQUENT’
speechTime=‘t1’>I</NARRATOR>
<EVENT id=‘e2’ type=‘ACTION’ exists=‘true’
 duration=‘PT9H’>biked</EVENT>
with <CHARACTER id=‘c1’ form=‘Gregg’ exists=‘true’
```

```
 accessibleTo='n1 c1 c2'>Gregg</CHARACTER>
and <CHARACTER id='c2' form='Brooks' exists='true'
 accessibleTo='n1 c1 c2'>Brooks</CHARACTER>
for <TIME id='t2' value='P1D'>one more day</TIME>.
<TLINK id='r1' type='INCLUDES' relatedToEvent='e1' timeID='t1'/>
<TLINK id='r2' type='BEFORE' relatedToTime='t1' timeID='t2'/>
<TLINK id='r3' type='BEFORE' relatedToEvent='e2' eventID='e1'/>
<TLINK id='r4' type='INCLUDES' relatedToEvent='e2' timeID='t1'/>
<TEMPO storyTime='P1D' readingLength='PT4S'/>
</NARRATIVE>
</NarrativeML>
```

The aspectual event of "leaving" is annotated with varying durations in the TimeBank of Pan et al. (2011), with the maximum lower bound being one month. The context in our case is clearly different; I have estimated an average duration of a generous two hours to get out of town, allowing for traffic. The event of "biking" is not annotated in their TimeBank; I have given it an average duration estimate of nine hours. For the tempo, the 19-word one-sentence micro-story spanning a story time of one day is estimated, given a reading speed of 300 words per minute, as taking approximately four seconds to read[10].

## 3.7 CONCLUSION

In this chapter, I have described methods for representing and computing events, times, and temporal relations in narrative, the latter represented in terms of chronologies that are partial orderings based on qualitative relations from the interval calculus. Metric constraints are also represented, along with commonsense durations for events. Phenomena like tempo are also characterized and annotated. The representation impinges on issues of modality, addressed partially through subordination relations (represented in NarrativeML) and event factuality representations (represented in a separate annotation scheme from Saurí and Pustejovsky (2012)). These representations add an important empirical dimension to corpus-based narratology, allowing for particular temporal patterns in corpora to uncover, as we have shown, novel narratological insights.

Systems that generate narrative from a fabula are able to order the events in the discourse using any of Genette's orderings, and those that understand language are able to extract and resolve time expressions successfully. The latter systems can also order events in narrative discourse in terms of an underlying chronology. For more theoretical details on how these computational approaches relate to narratological discussions of time, see Mani (2010a).

However, many interesting research challenges remain:

[10]For a far more detailed temporal analysis of the longer travel blog from which this excerpt is taken, see Mani and Pustejovsky (2012) (p. 130–133).

- The modal issues mentioned above need further formal modeling beyond the interval calculus, including the use of models of branching time.
- The inferences regarding commonsense durations of events are highly coarse-grained and need to be extended much further.
- There is a pressing need to extend annotation schemes like TimeML to address phenomena characteristic of narrative such as habituals and scene-setting narratives.
- Ordering events qualitatively into the underlying chronology of the fabula faces a ceiling effect when systems are tested on corpora similar to those which they are trained on. And when systems are fed literary material that they have not been trained on, they seem not to fare particularly well.

# CHAPTER 4

# Plot

## 4.1 INTRODUCTION

### 4.1.1 BACKGROUND

Events are a key aspect of narrative. The *causal* connection between them has often been viewed as a factor influencing what makes a narrative compelling. The term **plot** is used to represent this causal aspect. As Forster (1956) argues, while what he calls a *story* is "a narrative of events arranged in their time-sequence," a *plot* is "also a narrative of events, the emphasis falling on causality." To quote from Forster (1956) (p. 86):

> "The king died and then the queen died," is a story. "The king died, and then the queen died of grief" is a plot. The time-sequence is preserved, but the sense of causality overshadows it. Or again: "The queen died, no one knew why, until it was discovered that it was through grief at the death of the king." This is a plot with a mystery in it, a form capable of high development. It suspends the time-sequence, it moves as far away from the story as its limitations will allow. Consider the death of the queen. If it is in a story we say: "And then?" If it is in a plot we ask: "Why?".

Plot in literary theory thus focuses on causal explanations for the events in the narrative. These can unfold due to the actions of agents or of other event participants, or other forces in the world.

Our everyday use of the term *plot* is somewhat looser, and covers summaries of what happened in the story (spoiler or not). It can involve a partial explanation of why things happened, and in that case is sometimes grounded in terms of inferences about agents' goals and beliefs. How much drill-down this involves can depend on the genre as well as who the reader or audience is. Clearly, certain types of events can recur across stories, e.g., marriage, death, abduction, or rescue; and some of the more interesting stories involve complex sequences of events such as punishment, betrayal, retaliation, etc.

Some informal plots provide only an abstract summary of the fabula, e.g., X was seduced; X later killed herself. This involves classifying event types in the fabula, leaving it to the audience to use background knowledge to guess in most cases why X might have done those things. We call these types of plot models **event summaries**. Here is an example event summary for *Hamlet*, from the Globe Theatre (Globe, 2012).

**Example 4.1** This drama is one of the great tragedy themed plays by William Shakespeare. The themes of the plot cover indecision, revenge and retribution, deception, ambition, loyalty and fate.

Prince Hamlet mourns both his father's death and his mother, Queen Gertrude's remarriage to Claudius. The ghost of Hamlet's father appears to him and tells him that Claudius has poisoned him. Hamlet swears revenge. He kills the eavesdropping Polonius, the court chamberlain. Polonius's son Laertes returns to Denmark to avenge his father's death. Polonius's daughter Ophelia loves the Prince but his behaviour drives her to madness. Ophelia dies by drowning. A duel takes place and ends with the death of Gertrude, Laertes, Claudius, and Hamlet.

Many modern modern works of so-called *literary* fiction (as opposed to genres such as detective or romance or fantasy stories) are less constrained by plot; here one might count novels such as Woolf's *The Waves* or Calvino's *Mr. Palomar*. At the same time, many more works, including the *Iliad*, have extremely complex plots that the reader may not keep track of. Some critics also try to classify all stories into being either *character-driven* or *plot-driven*. The point is, however, that even if a work is extremely difficult, or written so as to disregard various conventions for 'plotting', humans have a tendency to find structure and meaning in almost any arrangement of events.

### 4.1.2 ARISTOTELIAN PLOT

The emphasis on the causal connection between events in a narrative goes back to the 4th century BCE and Aristotle (1932). He defines *mythos*, which is often translated as "plot," as a sequence of events linked by necessity or probability. Focusing on the genres of epic poetry and drama, he distinguishes plot from other narrative sequences of events such as biography, where incidents in a person's life may lack a necessary and probable connection, and history, where (he says) events are confined to what actually happened, rather than hypothetical happenings. Plot is important, because the spectator reconstructs it in responding emotionally to the language of the drama: "For the plot ought to be so constructed that, even without the aid of the eye, he who hears the tale told will thrill with horror and melt to pity at what takes place." Aristotle (1932) (XIV).

In applying these notions to epic poems and tragic dramas, Aristotle defends his emphasis on events rather than characters. "Character determines men's qualities, but it is their actions that make them happy or wretched" (ibid., VI). However, plot is just one aspect of tragedy; the other aspects he included were character, diction, thought, spectacle, and song.

Aristotle's conception of plot involves *aggregation* over entire sequences of events, as in his plot for the *Odyssey*, from Aristotle (1932) (XVII):

**Example 4.2** A certain man is absent from home for many years; he is jealously watched by Poseidon, and left desolate. Meanwhile his home is in a wretched plight – suitors are wasting his substance and plotting against his son. At length, tempest-tost, he himself arrives; he makes certain persons acquainted with him; he attacks the suitors with his own hand, and is himself preserved while he destroys them.

Not all events are party to the plot: incidental events (which Aristotle calls *episodes*), while obviously present in a drama, do not form part of the plot "for a thing whose presence or absence makes no visible difference, is not an organic part of the whole." In essence, a plot, like the forms of other imitative arts, has a unity of action, involving an action that is complete and whole, and with a property of *compactness*, "the structural union of the parts being such that if any one of them is displaced or removed, the whole will be disjointed and disturbed."

Implausible plots, in Aristotle's definition, can involve unlikely or poorly motivated happenings. There are countless examples of these, some even flowing from the pens of gifted writers. For example, in Faulkner's novel *Wild Palms*, an impecunious medical intern just happens to discover, in a trash can, a wallet full of cash, which allows him to elope with a sculptress, their mutual attraction lacking any convincing prior development.

### 4.1.3 NARRATIVE ARC

The Aristotelian analysis develops a basic form of what is called the *narrative arc*. In more detail, from Aristotle (1932):

- He specifies a number of prescriptive guidelines for constructing suitable plots. These include having scenes of recognition, or *anagnorisis*, what he calls a change from ignorance to knowledge: "in the recognition of Odysseus by his scar, the discovery is made in one way by the nurse, in another by the swineherds." He also favors reversals of fortune, or *peripeteia* (ibid., XI):

  > "Thus in *Oedipus*, the messenger comes to cheer Oedipus and free him from his alarms about his mother, but by revealing who he is, he produces the opposite effect. ... The change of fortune should be ... from good to bad."

- He provides a three-phase substructure for a plot, with a beginning, middle, and end (ibid., VII):

  > "A beginning is that which is not a necessary consequent of anything else but after which something else exists or happens as a natural result. An end on the contrary is that which is inevitably or, as a rule, the natural result of something else but from which nothing else follows; a middle follows something else and something follows from it."

- Aristotle identifies a crucial inflexion point in the middle, called a turning point, which is a *complication* followed by an *unraveling* (ibid., XVIII):

  > "By the complication I mean all that extends from the beginning of the action to the part which marks the turning-point to good or bad fortune. The unraveling is that which extends from the beginning of the change to the end."

- In identifying beginning, middles, and ends, Aristotle seems to suggest that these are in order, i.e., an ordering of the discourse, not just the fabula. This is somewhat puzzling, since Aristotle was familiar with epic poetry as well as tragedies that began in the mode which Horace (1976) later (in the first century BCE) called *in medias res*, i.e., in the middle of things. Certainly, epic poetry, when recited orally, could vary the order of events in each telling.

Aristotle's three-part decomposition has been further refined by many others, especially Freytag (1900). In his scheme, drama goes through five successive stages, in keeping with the classical five-act play, illustrated by Abrams (1993) from *Hamlet*:

1. Introduction, also called Exposition. This is the setting and prior background, involving the sentinels meeting the ghost, "the starting call of the watch, the mounting of the guard, the appearance of the ghost" (Freytag, p. 118).

2. Rise, also called Rising action. This starts when Hamlet meets his father's ghost (Act 1, Scene 4), who reveals that the father was murdered by Claudius. This continues with Hamlet controlling, more or less, the course of events.

3. Climax. This begins (Act 3, Scene 2) when Hamlet confirms that Claudius is guilty when the latter leaves the room during the murder scene of the embedded play *The Murder of Gonzago*. It corresponds to Aristotle's notion of *complication*.

4. Fall, also called Falling action. This begins (Act 3, Scene 3) with Hamlet's failure to kill the king at prayer. The course of events is more or less controlled by Claudius.

5. Catastrophe, also called denouement. This is the catastrophe (Act 5, Scene 2) that ends with the deaths of Hamlet, Claudius, and the Queen. This corresponds to Aristotle's *unraveling*.

Freytag's narrative arc is often pictured as in Figure 4.1.

Freytag's analysis, unlike Aristotle's, does not focus specifically on events, or sequences thereof. It is often applied to highly varied units of discourse, from short passages to entire scenes of a play. When applied to the Greek and Shakespearean drama for which it was intended, it provides many examples but stops short of offering precise criteria as to what counts as an instance of each of these stages. The Freytagian scheme also does not apply to epic poetry, where the narrated order of events can vary substantially with each oral performance.

The narrative arc has nevertheless been relatively popular as a rubric for dramatic writing that focuses on plot. It has also influenced computational narratology, in particular, interactive storytelling, e.g., via extensions proposed by Laurel (1993), Murray (1997), Mateas (2000), and Mateas and Stern (2005). The key idea is to impose structure on an overall storytelling experience by forcing the narrative to follow a pre-specified narrative arc.

### 4.1.4 HEROIC QUESTS

Another popular rubric for plot is that of the **heroic quest**, where the inspiration comes from mythology. The study of comparative religion and mythology by Campbell (1949), described in his

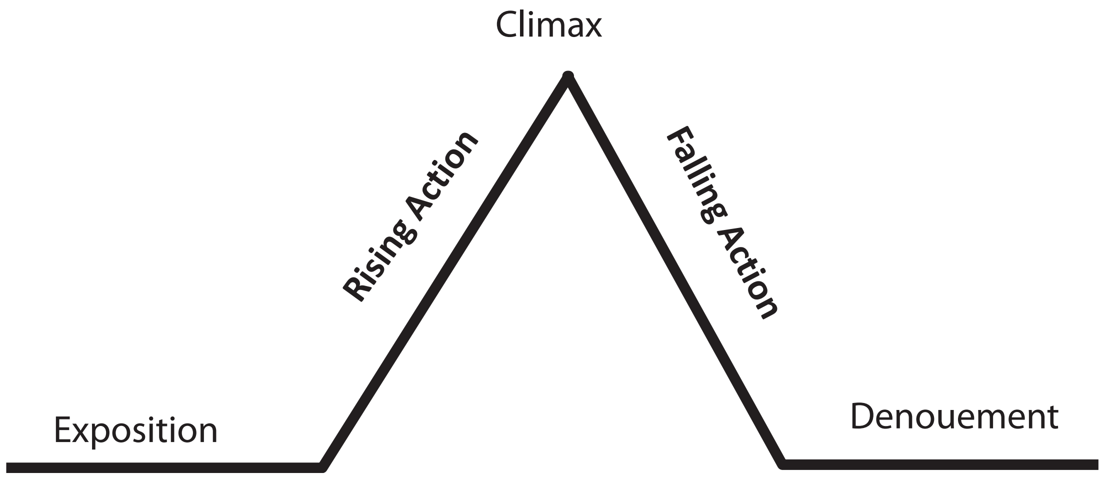


**Figure 4.1:** Freytag's Analysis of Drama.

1949 best-selling book *The Hero with a Thousand Faces*, was carried out within a tradition of Jungian psychoanalytic theory. Campbell found a common pattern across some of the world's myths, reflective of a rite of passage, that he called *monomyth* (a word borrowed from James Joyce's *Finnegan's Wake*). It involves the following scenario:

**Example 4.3** A hero ventures forth from the world of common day into a region of supernatural wonder: fabulous forces are there encountered and a decisive victory is won: the hero comes back from this mysterious adventure with the power to bestow boons on his fellow man.

There are three stages to the monomyth, which bottom-out in 17 stages in all:

1. Departure
   (a) The Call to Adventure
   (b) Refusal of the Call
   (c) Supernatural Aid
   (d) The Crossing of the First Threshold
   (e) Belly of The Whale
2. Initiation
   (a) The Road of Trials
   (b) The Meeting With the Goddess
   (c) Woman as Temptress

   (d) Atonement with the Father
   (e) Apotheosis
   (f) The Ultimate Boon

3. Return
   (a) Refusal of the Return
   (b) The Magic Flight
   (c) Rescue from Without
   (d) The Crossing of the Return Threshold
   (e) Master of Two Worlds
   (f) Freedom to Live

Prototypical examples of this monomyth are found in the story of Jason and the Golden Fleece, Aeneas and the founding of Rome, the life of the Buddha, the story of Moses, and so forth. Campbell's ideas, focused as they are on the most ancient stories across cultures (as well as by extensive reading of Joyce), have influenced critics as well as motivated writers, filmmakers, musicians, game designers, storytelling system developers, etc. Given the wide influence of these ideas, it is worthwhile examining them carefully.

In prescribing as it does an overall master plot, the monomyth tries to emphasize what Campbell believes are the universal commonalities across stories, without focusing on individual differences that arise in each particular instance.

As Dundes (2005) points out, the monomyth account has several shortcomings:

- Campbell is apparently unaware of the folkloric distinction between myths (which are religious explanations, as in creation myths), legends, which are narrations of historical or pseudo-historical events (e.g., the stories of Robin Hood), and folk tales, which are stories such as fairy tales, that are intended to be fictions.
- His similarity judgments are also far-fetched: the 'Belly of the Whale' notion tends to conflate the story of Jonah (male swallowed by whale) with that of Red Riding Hood (female devoured by wolf, but only in some versions).
- His claims of universality for certain themes (e.g., virgin birth) ignore the actual and skewed geographical distribution of such themes.

Although the heroic quest itself is a well-known narrative motif, its characterization by Campbell has influenced the design and analysis of role-playing games. Despite its fame, it is clearly a genre-specific, coarse-grained framework whose mapping to the fabula is unspecified. It is too abstract to provide enough of a detailed description that can be used to track plot given linguistic input, or to formulate a plot in such a way that it has a bearing on the events in the fabula and their expression in the discourse. Certainly, there are no specifications of required versus optional stages, or of dependencies within stages. It is also not really of much use for even the most basic of tales, such as *The Wily Lion* that was mentioned in Chapter 1.

## 4.2 NARRATIVE FUNCTIONS

Campbell's scheme was heavily influenced by Vladimir Propp's set of 31 ordered narrative elements, called *functions* or *narratemes*, first published in Propp's seminal book *Morphology of the Folktale* in Russian in 1928, see Propp (1968). Propp's work is attractive because of its formal nature, backed by detailed analyses of 10 sample stories drawn from a corpus of 100 Russian folk tales. To motivate his account, he considers stories which at the level of **narrative functions** seem very similar, even though the characters involved are different (from Propp (1968), p. 8):

1. "A tsar gives an eagle to a hero. The eagle carries the hero away to another kingdom."
2. "An old man gives Sucenko a horse. The horse carries Sucenko away to another kingdom."
3. "A sorcerer gives Ivan a little boat. The boat takes Ivan to another kingdom."
4. "A princess gives Ivan a ring. Young men appearing from out of the ring carry Ivan away into another kingdom."

In the above cases, all involve a common narrative function that Propp calls 'Receipt of a Magical Agent'. Narrative functions have four characteristics (ibid., p. 10):

i) "Functions of characters (*narratemes*) serve as stable, constant elements in a tale, independent of how and by whom they are fulfilled."

ii) "A function is an act of a character, defined from the point of view of its significance for the course of the action."

iii) "The number of functions known to the fairy tale is limited."

iv) "The sequence of functions is always identical."

The complete set of 31 narrative functions is shown in Table 4.1 (from Propp (1968)).

Each of these functions in turn has different types of subfunctions, indicated in Propp's notation by superscripts. For example, Villainy (A) can involve a variety of different subfunctions, including one where the villain abducts someone ($A^1$), and Receipt of a Magical Agent (F) can involve a subfunction where "Various characters place themselves at the disposal of the hero" ($F^9$).

Characters are also classified into eight categories: Hero, Villain, Donor, Despatcher, False Hero, Helper, Princess, Princess's Father. Finally, there are also about 150 *Elements*, some of which correspond to narrative functions; a mapping has been carried out by Scheidel and Declerck (2010).

**Table 4.1:** Propp's Narrative Functions

| Number | Symbol | Function | Number | Function | Symbol |
|---|---|---|---|---|---|
| 1 | $\beta$ | Absentation | 16 | Struggle | $H$ |
| 2 | $\gamma$ | Interdiction | 17 | Branding | $J$ |
| 3 | $\delta$ | Violation of Interdiction | 18 | Victory | $I$ |
| 4 | $\epsilon$ | Reconnaissance | 19 | Liquidation | $K$ |
| 5 | $\zeta$ | Delivery | 20 | Return | $\downarrow$ |
| 6 | $\eta$ | Trickery | 21 | Pursuit | $Pr$ |
| 7 | $\theta$ | Complicity | 22 | Rescue | $Rs$ |
| 8 | $A$ | Villainy/Lack | 23 | Unrecognized Arrival | $o$ |
| 9 | $B$ | Mediation | 24 | Unfounded Claims | $L$ |
| 10 | $C$ | Beginning Counter-Action | 25 | Difficult Task | $M$ |
| 11 | $\uparrow$ | Departure | 26 | Solution | $N$ |
| 12 | $D$ | First Function of the Donor | 27 | Recognition | $Q$ |
| 13 | $E$ | Hero's Reaction | 28 | Exposure | $Ex.$ |
| 14 | $F$ | Receipt of a Magical Agent | 29 | Transfiguration | $T$ |
| 15 | $G$ | Guidance | 30 | Punishment | $U$ |
| 31 | $W$ | Wedding | | | |

Consider an example story *The Magic Swan Geese*, story number 113 from the corpus analyzed by Propp. Example 4.4 shows a condensed version of it.

**Example 4.4** A girl was left in charge of her younger brother by her parents, but she didn't keep an eye on him and he was snatched away by swan geese. She chased after them, passing an oven, an apple tree, and a river of milk, each of which offered her delicacies which she declined. She finally arrived at a hut where Baba Yaga was sitting with her brother. Baba Yaga asked her to stay and spin flax, and left. A mouse came out and in exchange for porridge, revealed that Baba Yaga had gone to prepare the bath house so she could be steamed and then eaten. The girl fled with her brother, but Baba Yaga sent the swan geese after her. This time, seeking help from the river, apple tree, and oven, she accepted their offerings and was able to hide from the swan geese. She reached home with her brother in time for her parents' return.

The full story has been analyzed into the following sequence of narrative functions by Scheidel and Declerck (2010):

**Example 4.5** $\gamma^1\beta^1\delta^1A^1C\uparrow\{[DE^{\mathrm{n}}eg.Fneg.]^3d^7E^7F^9\}G^4K^1\downarrow[Pr^1D^1E^1F^9=Rs^4]^3$

However, other 'parses' are clearly possible.

Propp's event ordering of the events in the fabula is corpus-specific, but the functions themselves are of broader applicability. His account has been influential in the design of adventure games, the analysis of movies, etc. For example, Grasbon and Braun (2001) describe a partially implemented interactive storytelling system based on Proppian functions. By far the most developed of the Proppian systems is PROTOPROPP, developed by Peinado and Gervás (2006), which generates stories using Case-Based Reasoning. The cases are indexed by the 31 Proppian functions (structured as an event hierarchy) and character types.

PROTOPROPP generates new story fabulas from a query by retrieving similar fabulas from the case base, while randomly deleting some narrative functions not in the query (along with dependents), and adding others and dependents at random. It uses backtracking when constraints related to the participation of characters in Proppian functions are violated. Here, in Example 4.6, is a story that gets generated based on automatic modifications to *The Magic Swan Geese* fabula.

**Example 4.6** Once upon a time there was a princess. The princess said not to go outside. The princess went outside. The princess heard about the lioness. The lioness scared the princess. The lioness kidnapped the princess. The knight departed. The knight and the lioness fought. The knight won the fight. The knight solved the problem of the princess. The knight returned. A big treasure to the knight.

The PROTOPROPP ontology is in turn being linked to a Proppian annotation of folk tales by Scheidel and Declerck (2010) to support information extraction.

However, attempts to take Proppian annotation further so as to make it of practical use have not made much progress. Block et al. (2012) carried out experiments in annotating some of the folk tales in Propp's corpus. They discovered that:

- "Proppian descriptions of some of the dramatis personae (e.g., the Hero) and functions (e.g., H, i.e., Struggle) are vague and require a large amount of interpretation."

- "The Proppian framework encourages the marking of minor events that do not naturally occur in summaries of the same folktales."

Given these problems, they conclude that further inter-annotator studies are not worthwhile. It is hard to disagree with such a conclusion.

## 4.3 STORY GRAMMARS

Given a formal pattern such as the one in Example 4.5, it is natural to wonder about a mechanism for generating such patterns using a declarative formalism. Propp's work has influenced the development of story grammars, where narrative functions are expressed via rewrite rules. They were proposed for use in AI by Rumelhart (1977), among others.

The system BUILDTALE, from Correira (1980), integrates the AI approach of Rumelhart with work in linguistics by van Dijk (1980), while in addition leveraging script-like mechanisms. In the theory of Macrostructures of van Dijk (1980), propositions corresponding to individual sentences in a story are linked together by various relations to form an overall story. These relations can include causal and temporal ones, as well as thematic relations, as in the case of a scene-setting description. The networked of linked propositions is then mapped to a hierarchical representation, corresponding, in the case of stories, to Aristotelian categories such as Introduction, Complication, and Resolution. In BUILDTALE, a story may be made up of a Setting followed by an Episode. An Episode is defined recursively as either (i) an Interlude which leads into an Episode followed by a new Episode, (ii) a Complication followed by a new Episode, or (iii) a Complication and a Resolution.

Consider a fragment of a story from Boccaccio's *Decameron*, used by Correira (1980):

**Example 4.7** Rufolo made the usual calculations that merchants make. He purchased a ship and loaded it with a cargo of goods that he paid for out of his own pocket. He sailed to Cyprus. When he got there he discovered other ships docked carrying the same goods as he had. Therefore he had to sell his goods at bargain prices. He was thus brought to the verge of ruin. ... He found a buyer for his ship. He bought a light pirate vessel. He fitted it out with the equipment best suited for his purpose. He then applied himself to the systematic looting of other people's property, especially that of the Turks. After a year he seized and raided many Turkish ships and he had doubled his fortune.

Understanding this story relies on scripts for travel, trading, etc. A script for an abstract event such as a trading voyage (involving a sailing trip carrying goods to a destination for trading) is implemented in BUILDTALE as a rule. A ship can be purchased by the agent, subject to the precondition (a subgoal) of the agent possessing wealth, then the ship being loaded, then sailed to the destination, following which goods will be traded. Likewise, rules are specified for purchasing, trading, for a pirate voyage, etc. As a result of purchasing, the wealth used for the purchase is no longer in the possession of the purchaser. These rules can be fairly complex, and are closely tied to the examples the system is run on. For example, the trading rule involves adversarial competition, based on the assumption that there are other ships in the destination dock that have the same goods.

Turning to natural language generation, the system JOSEPH of Lang (2003) generates stories using a story grammar. A story is stated in terms of a setting and its episodes, which are in turn made up of events. The affect state of a protagonist, the action carried out, and its result are all represented. Episodes can be sequential, or nested (e.g., the action of an outer episode triggers an event which initiates a new episode). Domain knowledge is used to instantiate a story in terms of agents, facts, events, and plans which agents can carry out – or fail to carry out – based on world state. Stories of various levels of complexity can be generated, all involving a single protagonist.

All in all, story grammars have several disadvantages:

- They inherit the brittleness of Schankian scripts.
- They can be interpreted as models of the discourse, rather than the fabula (even though their original formulation does not cite the story/discourse dichotomy)[1]. As such, they fail to decouple the order of events specified in the grammar from their discourse order; the two have to be the same. Thus, they face problems when these two diverge. For example, in a retrograde story, the outcome may be provided in advance.

Having made such pejorative remarks about story grammars, the reader may wonder about my use, in analyzing character goals in Chapter 2, of the *Move*-grammar of Pavel (1982). While both use grammar-like rules, the latter captures the underlying intentional structure of the narrative at the level of the fabula, rather than (as in story grammars) the constitution of the discourse in terms of settings and episodes[2]. The approach of Pavel (1982) also does not make any fine-grained commitments regarding temporal order. Whether it is precise enough to be annotated reliably remains to be seen.

## 4.4 CAUSAL MODELS OF PLOT

### 4.4.1 PLOT UNITS

In the discussion so far, the models of plot have been behavioral, without taking into account the mental states of agents involved in events, and in particular ignoring the representation of their motives and goals. The account of plot offered by Lehnert (1981) represents characters' motivations for events, and their outcomes on characters (represented by positive (+) and negative (−) affect states, or emotions, for those characters). Motivations are represented as affect states ($M$) that are neutral. As events unfold, the causal relations between them are represented in terms of links between affect states of a given character involved in the event. A plot is viewed in terms of a graph of causal links between emotional states of characters; their beliefs and the events they are involved are not directly represented.

There are two types of causal links: a motivation link ($m$) between a negative outcome (−) and a mental state ($M$), reflecting the mental state caused by an external event, and an actualization link ($a$) between $M$ and +, representing intentionality behind an event. In addition, there is a termination link ($t$) between mental states or between event outcomes, used when an event supplants or displaces the affective impact of a previous event, e.g., a second marriage *terminating* a divorce. Finally, there is an equivalence link ($e$) between mental states or between event outcomes, that represents a new situation that is similar to a previous situation. The termination and equivalence links thus run

[1] However, authors such as Ryan (1991) have construed story grammars as transformational grammars, with the context-free rules generating the structure of the fabula and the output of transformational rules responsible for the production of the discourse.

[2] This point was also argued earlier in Chapter 2, but it is worthwhile reiterating here.

backward in time, in contrast to the (causal) motivation and actualization links, that run forward in time.

In addition to these four types of links involving a single character, there are cross-character links between affect states. For example, when, say, John wants to get his car started (*M*), and Paul agrees to help (*M*), there is a cross-character link between those two affect states, reflecting the fact that Paul has in this instance shared John's goal; and when Paul actualizes his goal to get it started (+), that results in a positive outcome for John (+), who has now actualized his own goal, albeit indirectly. Thus there is also a cross-character link between those latter positive affect states.

Particular recurring configurations in graphs are called **plot units**. The situation of Paul helping John by getting the latter's car started is a primitive plot unit called an Honored Request, shown in Figure 4.2.

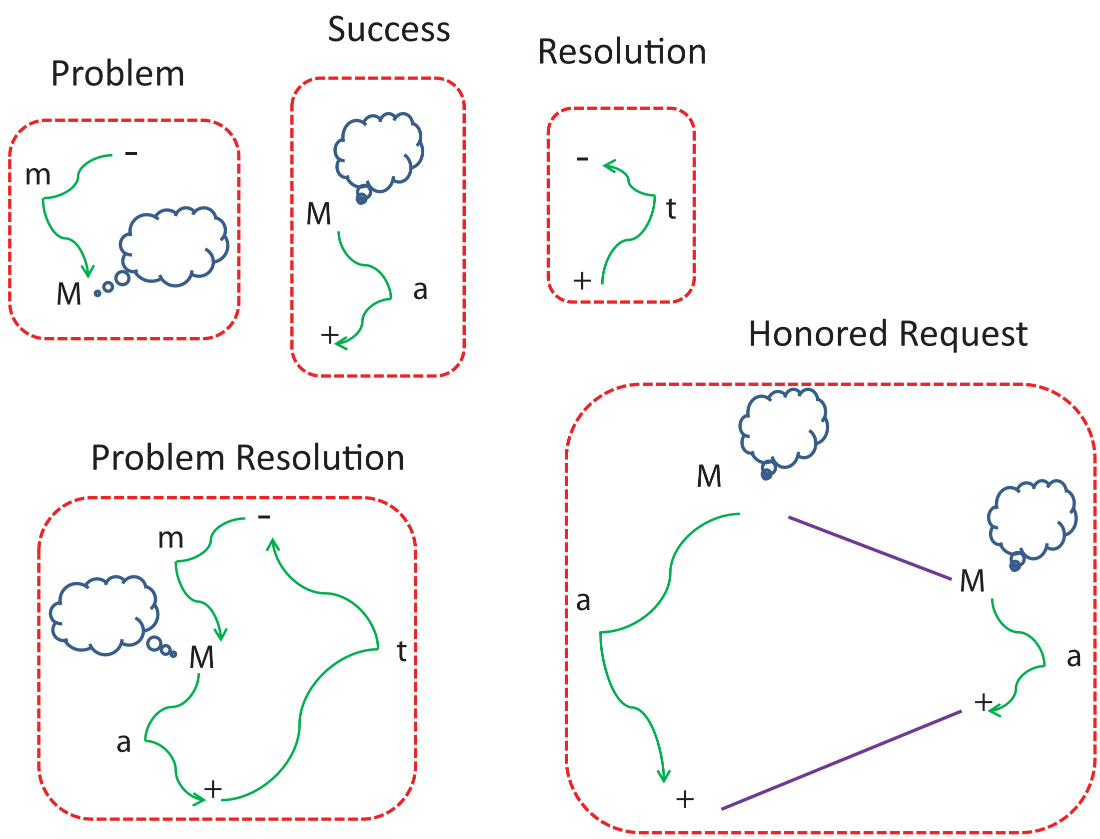


**Figure 4.2:** Simple and Complex Plot Units.

Figure 4.2 also reveals that an Honored Request is a complex plot unit made up of two primitive Success plot units, connected by cross-character links. Also shown is another complex plot unit called Problem Resolution, made up of three primitive plot units: Problem, Success, and Resolution.

Variants of an Honored Request include a Denied Request, where Paul does not necessarily share John's goal, being too busy; in this case, Paul's actualization, which by definition results in a positive outcome for him, results in (via a cross-character link) a negative outcome for John.

To see how primitive plot units are put together into complex plot units for a given narrative, consider Example 4.8 from Lehnert (1981):

**Example 4.8** John was thrilled when Mary accepted his engagement ring. But when he found out about her father's illegal mail-order business, he felt torn between his love for Mary and his responsibility as a police officer. When John finally arrested her father, Mary called off their engagement.

The analysis of this example in terms of primitive and complex plot units is shown in Figure 4.3, where the simple and complex plot units involved, Success ($S(M)$ and $S(J)$), Problem Resolution ($RES(J)$), Loss ($L(J)$), Retaliation ($RET(M)$), and Tradeoff ($TO(M)$) are indicated by labeled boxes.

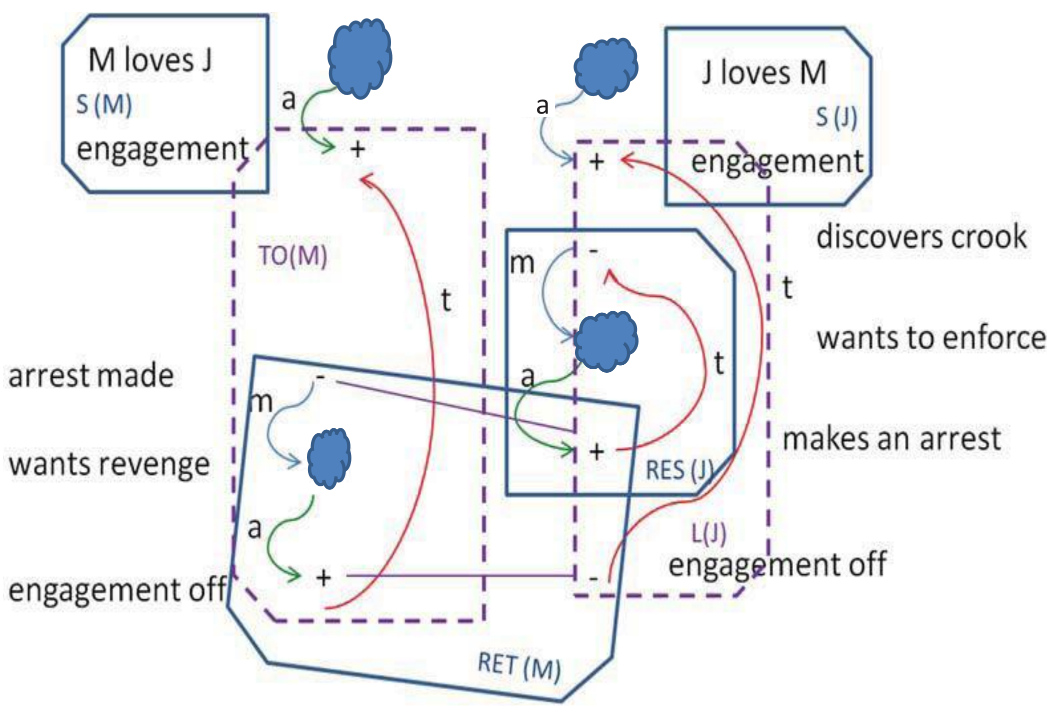


**Figure 4.3:** Plot Units in *Engagement* Story.

Essentially, in the plot unit analysis, their being in love results in an actualization (a) of becoming engaged which results in a positive affect (+) for each. When he discovers Mary's father is a crook, John is in a negative affect state (−). This motivates ($m$) him to a mental state of wanting to enforce the law ($M$), which is actualized ($a$) by his making an arrest, resulting in a positive affect (+) for him, terminating ($t$) his negative affect. By a cross-character link, this results in a negative affect state (−) for Mary, who is motivated ($m$) to a mental state ($M$) of wanting revenge. This is actualized ($a$) by the event of her calling off the engagement, resulting in positive affect (+) for her, but by a cross-character link, a negative affect (−) for John, which results in terminating ($t$) his initial positive affect (+) from the engagement.

As can be seen, the plot unit analysis is both sophisticated and expressive. But is this plot a reasonable explanation of the causal structure of the narrative? Clearly, John's getting engaged is motivated by his being in love, which is a reasonable ground for doing so. John's arresting her father is based on his wanting to enforce the law; this does not, however, ground the explanation in terms of any higher moral goal or belief about the importance of laws.

Lehnert's analysis has a number of limitations:

- The model of emotion is severely limited (although such ternary classifications of emotion are hardly uncommon, having been prevalent since antiquity). Thus, in the Engagement story, John's feeling torn between two affects is not directly expressible in the framework of Lehnert (1981). It is also awkward and moreover unrealistic to have all actualizations result in positive affect.

- Beliefs are not represented, restricting the grounding of explanations.

- The framework does not specify a complete set of primitive plot units, though Lehnert (1981) discusses at least 15.

- While the plot units themselves are defined precisely, there are no guidelines for whether to mark a mental state or event in a given situation, resulting in potential ambiguity. This in addition leaves the grounding of explanations rather open-ended.

At present, the reliability of annotators in annotating entire plots based on her scheme is not known, and neither has the plot unit approach been fully implemented.[3] However, Goyal et al. (2010) have developed, based on a corpus, a system that can infer, for each event, its possible affects (+, -, or M) for each human participant in the event. This is done by flagging verbs, especially those that involve mental states, speech events, etc., as well as those that impart a positive or negative polarity to their arguments (i.e., the verb's 'object', or *patient*), e.g., "rescued" versus "scammed." They next use the polarity information in affect projection rules to determine which participant (i.e., *patient* argument) receives which affect, e.g., Mary in "Mary laughed," but the cat in "Mary hated the cat." They then compute actualization, termination, and motivation links between affect states

[3]The same is true of the enhanced account of Plot Units found in Ryan (1991), where agents' mental states are added to the representation.

using simple heuristic rules. The results for affect identification, over a test of 15 fables from Aesop, are a weak 45% F-measure. However, for link identification, their system scores 92% F-measure on actualization links and 72% F-measure on motivation links (with perfect, i.e., human, affect identification). The human agreement on affect identification is 0.7 Kappa, which is commonly viewed as high agreement. It turns out people largely agree on whether a verb is bad for the patient argument, but they do not necessarily agree if not whether it is good for the patient.

### 4.4.2 BREMOND'S APPROACH

Propp's ideas have been extended considerably by Bremond (1980) in a logical approach that is not very far off from Plot Units. Bremond's approach, first published in French in 1966, and later expanded in an English translation in 1980, is based on what he calls an *elementary sequence*, which consists of three obligatory phases of any process: what might be called a goal, an action, and a result. This seems, at first glance, not very different from plot units. However, Bremond's approach, while formal, is structuralist rather than computational. While plot units fit nicely into a framework involving agents making plans and executing them, Bremond's approach is more focused on patterns of plot, and, in keeping with the structuralist approach, offers insights on particular symmetries that reflect parallelism and opposition. Bremond's notion of event outcome is also more nuanced than Lehnert (1981): actions can affect an agent by having her situation ameliorate or deteriorate (analogous to positive and negative outcomes in Plot Units), or the situation (either favorable or unfavorable, i.e., positive or negative in plot unit terms) can remain the same. When more than one agent is involved, their relationships can be cooperative or adversarial; processes can involve intervention, negotiation, aggression, retribution, sacrifice, and punishment.

Although Bremond's theories are not cast in computational terms, they have influenced the approach of Pavel (1982) discussed in Chapter 2, as well as systems such as those of Schäfer et al. (2004) and Cavazza and Charles (2005).

### 4.4.3 DOXASTIC PREFERENCES

Löwe (2010) describes a formalism called the Doxastic Preference Framework (DPF) for representing the expectations of characters in a narrative. It uses game trees that reflect the beliefs of characters about the preferences of other characters (as well as themselves) regarding the outcomes of events. The DPF analysis of the *Engagement* story is shown in the game tree Figure 4.4.

We start in the non-terminal node $v0$, where John finds out about Mary's father. If he does not arrest him, the story would reach the terminal node $t0$. Instead, he does arrest him, and the story reaches non-terminal node $v1$. This results in an unexpected event for Mary (assuming no other events intervene, such as his sharing his discovery with her). If Mary decides not to call off the engagement, the story would end in terminal node $t1$. Instead, she ends the engagement, reaching terminal node $t2$. This is an unexpected action by Mary for John.

There are eight *building blocks*, such as Unexpected Action, Collaboration Gone Wrong, Betrayal, etc. These have been used to annotate a corpus of seven stories that are plot summaries

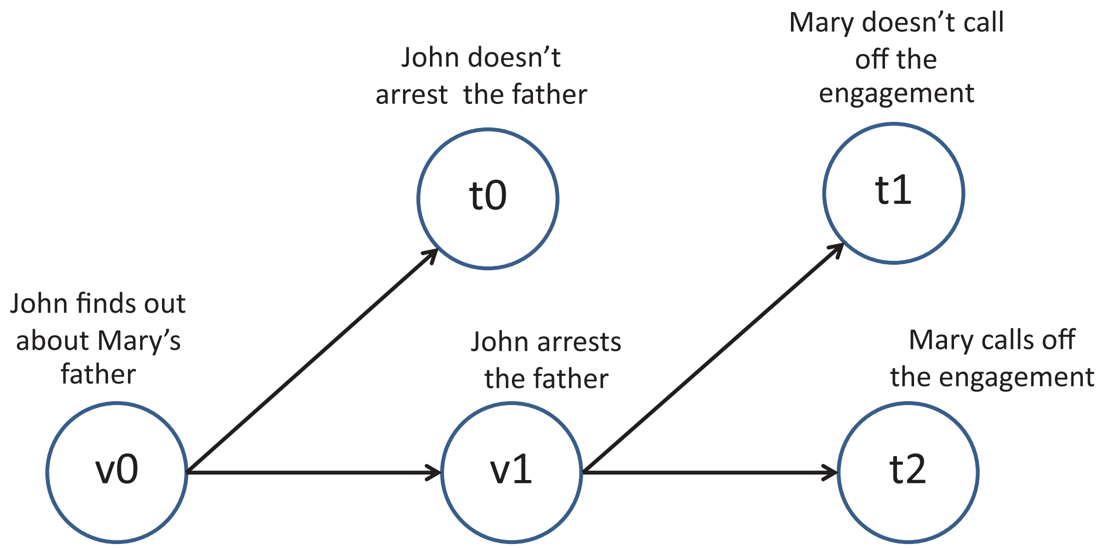


**Figure 4.4:** *Engagement* Story in DPF.

of Crime Series Investigation episodes by van Andel (2010). Unfortunately, no guidelines or inter-annotator reliability is available. In any case, for an annotator to hazard a guess as to what is a more likely reaction by one character to another's action can be problematic. While the scheme is quite expressive in terms of expressing beliefs about other's actions, and beliefs about beliefs, etc., it otherwise suffers from similar deficiencies to the scheme of Lehnert (1981).

### 4.4.4 STORY INTENTION GRAPHS

More elaborated versions of plot that build on the idea of plot units are found in Elson (2012), who develops the concept of Story Intention Graphs (SIGs). SIGs are graph structures that include an interpretive layer linked to the propositions in the fabula as well as the text in the discourse. The interpretive layer consists of the beliefs, goals, and plans of agents, in addition to representing temporal relations between events. Consider again our fable from Aesop, *The Wily Lion*, which we encountered first in Chapter 1:

**Example 4.9** A Lion watched a fat Bull feeding in a meadow, and his mouth watered when he thought of the royal feast he would make, but he did not dare to attack him, for he was afraid of his sharp horns. Hunger, however, presently compelled him to do something: and as the use of force did not promise success, he determined to resort to artifice. Going up to the Bull in friendly fashion, he said to him, "I cannot help saying how much I admire your magnificent figure. What a fine head! What powerful shoulders and thighs! But, my dear friend, what in the world makes you wear those ugly horns? You must find them as awkward as they are unsightly. Believe me, you would do much better without them." The Bull was foolish enough to be persuaded by this flattery to have his horns cut off; and, having now lost his only means of defence, fell an easy prey to the Lion.

In annotating the interpretive layer for this story, the annotator has to represent implicit information such as the the lion's belief that using force with the bull will result in his being gored by the lion, preventing his goal of eating the bull, and that the lion therefore has a goal to flatter the bull, so that the bull will trust the lion. The representation of such beliefs makes the SIG formalism more expressive than plot units, allowing for better-grounded explanations. To generate such a story using planning formalisms may be possible using the techniques described in Chapter 2, which would require domain knowledge and a library of relevant plans. Here, annotating such information can be at least as hard. Without strict guidelines, the choice of what goals to represent and which plans to use can be very open-ended.

A corpus of more than 60 stories, including fables from Aesop, stories by Chekhov and F. Scott Fitzgerald, etc., have been annotated by Elson (2012), creating a DramaBank. Here, the annotators are instructed only to annotate those goals and actions that are crucial to the evolution of the narrative. Inter-annotator studies by Elson (2012) have shown agreement of 0.55 kappa, suggestive of moderate agreement. (Here annotators were asked, in cases of plural or divergent interpretations, to settle on a single reading.) Deliberate authorial ambiguity, especially as found in literary texts, remains a problem. In addition, the goal-action representation is felt to be adequate for some texts, but too constraining for others. An annotator working on the SIG for a Chekhov story is quoted in Elson (2012, p. 197) as saying: "I think the main problem here is just that Chekhov's style is very difficult to break down into the goal-oriented structure, since large swaths of the story consist of characters looking over the water and realizing beauty and pointlessness."

Analysis of common SIG patterns in the DramaBank show more than 80 patterns, giving rise to plot unit-like structures such as Deception, Change-of-Mind, Peripeteia, Anagnorisis, etc. The SIG approach departs from earlier work in specifying a mapping from semantic representations of sentences to the interpretive layer required for modeling the beliefs of characters. Here, unlike the specification of Lehnert's, not only is there a representation of the fabula, but there is a precise indication of what text segment a plot unit applies to. There is alas no automatic capability for annotation of SIGs.

## 4.5 NARRATIVE EVENT CHAIN SUMMARIES

The problem with representations based on goals, beliefs, and plans, as well as plot units, is that they are hard to infer, especially when the story is not about such plans. It may be more feasible, from a practical standpoint, to view the extraction of plots as a summarization problem, addressing plot as an event summary rather than a structure based on plot units that involves referencing the implicit goals and beliefs of the characters.

Here the notion of a Narrative Event Chain (NEC) of Chambers (2011) becomes relevant. An NEC is a temporal sequence (actually, a partial temporal ordering) of narrative events that share a common protagonist. NECs are inspired by, but less expressive and computationally expensive than scripts. However, they can be rather long, and can involve incidental events. More importantly, they can be extracted accurately from text, as shown in an evaluation involving completion of chains by Chambers (2011).

Although NECs have not been used to address problems of plot, my idea is to compress these event chains, excising less salient events without exceeding the desired compression rate, so as to provide a plot summary. Such an approach can be formulated as a knapsack problem of picking a subset of the NECs such that their total length is less than a limit but where their total value, i.e., salience, is maximized. (This knapsack problem can in turn be solved by the mathematical optimization method known as dynamic programming.) To render the chains, we integrate them together to produce a summary. The summary can then be smoothed by referencing a particular temporal ordering template, as well as the use of coreference.

Turning to our *Engagement* story, the NECs are as follows:

**Example 4.10** NECs(J): M accepted J's engagement ring; Thrilled; Found out about M's father's biz; Felt torn; Arrested M's father.

NECs(M): Accepted J's engagement ring; Called off their engagement.

*Summary*: Mary accepted John's engagement ring; John arrested Mary's father; Mary called off their engagement.

*Smoothed Summary*: Mary accepted John's engagement ring. Then, when John arrested her father, she called off their engagement.

For *The Wily Lion*, my NEC approach could yield the summary:

**Example 4.11** L watches B feeding in meadow; L wants to eat B; L is afraid of B's horns; L persuades B by flattery to have his horns cut off; L kills B.

To obtain such an abstract summary, the metaphor of the lion's mouth watering would have to be interpreted, to yield "L wants to eat B." In addition, protagonists and different types of events would have to be weighted for salience.

It is worth noting that in the Engagement story, my approach of summarizing NECs does not require disambiguating the word sense of "engagement," and understanding that this sense of engagement can involve the use of rings (e.g., via a subculture-specific script), and understanding the meaning of "calling off." Such a knowledge-intensive approach is infeasible. Along the same lines, the summary suggested by Lehnert (1981), is:

**Example 4.12** *Smoothed Summary*: Because John arrested Mary's father, she called off their engagement.

The approach of Lehnert (1981) involves deriving a graph of plot units which are connected together based on characters sharing common affects, and then selecting the most salient ones based on connectivity patterns in the graph, followed by text smoothing operations. This is fine in the context of a knowledge-intensive, domain-specific system. My approach is more domain-independent, but what is lacking is the inference of causality that is present (cf. "because") in Lehnert's summary. Here, my approach could be augmented using techiques for deciding which pairs of propositions in the summary are more likely to be causally linked. In this regard, the Choice of Plausible Alternatives (COPA) evaluation of causal reasoning by Gordon et al. (2011) is highly relevant. In this evaluation task, a set of 1,000 causal reasoning questions is provided, along with candidate answers. For example:

**Example 4.13** I knocked on my neighbor's door. What happened as a result?
Alternative 1: My neighbor invited me in.
Alternative 2: My neighbor left his house.

Gordon et al. (2011) compute a simple statistic called Pointwise Mutual Information between words in the premise and in each alternative based on frequencies for those word pairs in a large text corpus (1 million personal blogs), choosing the highest scoring alternative. They obtained 62% accuracy, which is encouraging.

Another relevant data point is the work of Kazantseva and Szpakowicz (2010) on summarization of short stories. There, features related to character mentions, lexical aspect, and location are extracted from clauses, providing salient information about the settings of stories. Their system yielded good summary evaluation results using human judges. These methods could be usefully integrated with plot summarization.

## 4.6 COMPARISON OF PLOT MODELS

We are now in a position to summarize our comparison of selected plot models, shown in Table 4.2. It can be seen that no single model has at present all of the desired characteristics.

**Table 4.2:** Comparisons of Plot Models.

| Model | Elements | Reliability | Computability |
|---|---|---|---|
| Narratemes | events, char. types | low | generation |
| Plot Units | affect, links | good (affect) | good (link) |
| DPF | beliefs, preferences | unknown | unknown |
| SIG | beliefs, goals, affect, time | good | unknown |
| *Move*-grammar | goals | unknown | unknown |
| NEC | events, time | unknown | good |

## 4.7 NARRATOLOGICAL IMPLICATIONS

The creation of plots for narratives, whether based on computational approaches such as Plot Units, SIGs, *Move*-grammar based models, and/or NECs, offers interesting explorations relevant to the interests of humanities narratology:

- Finding stories with similar plots. Consider Aesop's *The Fox and the Crow*, translated by Jones (1912), shown in Example 4.14.

  **Example 4.14** A Crow was sitting on a branch of a tree with a piece of cheese in her beak when a Fox observed her and set his wits to work to discover some way of getting the cheese. Coming and standing under the tree he looked up and said, "What a noble bird I see above me! Her beauty is without equal, the hue of her plumage exquisite. If only her voice is as sweet as her looks are fair, she ought without doubt to be Queen of the Birds." The Crow was hugely flattered by this, and just to show the Fox that she could sing she gave a loud caw. Down came the cheese, of course, and the Fox, snatching it up, said, "You have a voice, madam, I see: what you want is wits."

  As Elson (2012) shows, the results from automatic comparison of this fable with *The Wily Lion* at the level of their SIG annotations confirm our narratological intuitions about the reasons for their similarity: "the fox is like the lion and the crow is like the bull, in that in both stories, one is an inciting agent who devises a plan that has the other agent devising and executing its own plan. This particular analogy is further enriched by the aligned use of the flatter predicate in the plan" (ibid., p. 230). Comparison of stories through NECs is even simpler, and is a clear possibility for future research. Altogether, such comparison algorithms allow for far more intelligent searching for similar stories than has been possible earlier. Such searches can greatly aid the narratologist in making claims to support theory development. They can also help clarify what it is we mean when we attribute a common plot to different narrative versions, say, of fairy tales like *Little Red Riding Hood*.

- Integrating NECs with *Move*-grammars. This seems a natural fit, where the nodes in the trees are labeled with NECs. This is shown for the *Engagement* story in Figure 4.5.

  The numbered nodes in the tree in Figure 2.2 have the following NEC labels:

  1. J: found out about M's father's business.
  2. J: arrested M's father.
  3. M: called off their engagement.

  However, like SIGs, *Move*-grammars may be felt to be too constraining for certain texts.

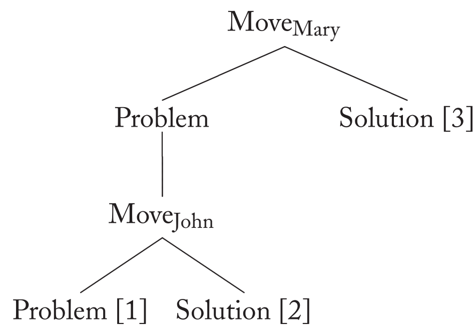


**Figure 4.5:** *Move*-grammar Analysis of *Engagement* story.

- Identifying causes for ambigous contexts. Ambiguity may arise for a variety of reasons: (i) deliberate authorial ambiguity; (ii) genuine ambiguity due to lack of information, language, etc.; or (iii) a reflection of the inherent subjectivity of certain types of interpretation related to agents' motives, feelings, and beliefs. These missing values are often a cue for the narratologist to examine further the causes and significance of the ambiguity. The provision of numerous such contexts by a system can be a useful aid.

- Dealing with goals related to non-existent characters, whom we have encountered in narratives like *A Beautiful Mind*, *The Continuity of Parks*, *The Thousand and One Nights*, etc. The plot model used, whether SIGs or NECs, must allow for agents whose `exists` flag is false, who are accessible only to certain agents. Metalepsis, for example, has not, to my knowledge, been addressed in the context of any of the models we have seen here.

- The above plot models have not been extended to handle narrator goals. Without representing such goals, the endings (discussed in Chapter 2, Section 2.5) in *Tess of the d'Urbervilles* and *1984* make no sense.

## 4.8 NarrativeML

We can now enhance NarrativeML further, appending NECs to the representation:

**Example 4.15**

```
<?xml version='1.0'?>
<!DOCTYPE NarrativeML [
...
<!ELEMENT NARRATIVE (#PCDATA | NARRATOR | AUDIENCE | CHARACTER |
 EVENT | TIME | PLACE | TLINK | SLINK | EVALUATION |
 GOAL | TEMPO | NEC)*>
```

```
...
<!ELEMENT NEC EMPTY>
<!ATTLIST NEC id ID #REQUIRED>
<!ATTLIST NEC entity IDREF #IMPLIED>
<!ATTLIST NEC events IDREFS #IMPLIED>

]>
```

## 4.9 CONCLUSION

It should be clear from this chapter that there has been a considerable body of work trying to formalize plot. Recent work has emphasized affect states, beliefs, and expectations of characters, but has not successfully addressed the practical issues of automatic annotation in the large. A more viable summarization-oriented approach, which can also be integrated with *Move*-grammars, raises its own issues. In particular, there is a need to resolve metaphors, to summarize discourse with varieties of narrative distance (interior monologue, quoted speech, etc.), to weight protagonists and event types, and to learn what common patterns can be induced from summaries. Developments in entailment tasks dealing with causality can help further this research area.

# CHAPTER 5

# Summary and Future Directions

## 5.1 SUMMARY

### 5.1.1 CHAPTER SUMMARIES

Let me begin by reviewing the contributions of this book.

Chapter 1 introduced basic notions from narratology, including concepts of narrator, audience, narrative distance, and narrator perspective, as well as temporal concepts. I sketched a new approach for representing embedded narratives as well as accessibility relations among narrative entities, and introduced an annotation scheme called NarrativeML. I also indicated how other layers of annotation could supplement NarrativeML.

In Chapter 2, I discussed how story understanding and generation made use initially of scripts and subsequently incorporated plans and case-based reasoning. Planning focuses on the workings of intentionality in narrative, and as such feeds into representations for plot discussed in Chapter 4. Nevertheless, planning-based approaches have narratological limitations. Instead of using fine-grained plans, I have advocated *Move*-grammars, the coarse-grained goal representation of Pavel (1982), incorporating it into NarrativeML. Obviously, the reliability of human annotation using it needs to be studied; further, it may turn out to be too constrained for use in certain varieties of modern literature. Finally, turning to interactive narrative planning, current systems allow for highly immersive environments to be experienced by a player or audience who can play the role of a character. However, the balance between authorial and audience control remains a challenge. Here, I sketched an initial version of a theory of audience satisfaction, enhancing NarrativeML accordingly. This theory needs to be expanded, and integrated with planning and narrative generation approaches.

Chapter 3 discussed techniques for representing and computing events, times, and temporal relations in narrative. I described the representation of chronologies in terms of qualitative relations from the interval calculus, as well as metric constraints that include commonsense durations. Tempo was also modeled. The representation impinges on issues of modality, addressed in part via the representation of subordination relations and event factuality. Examples were provided of reasoning about temporal relations in understanding and generating stories, describing in some detail novel computational analysis of time in literary narratives, exemplifying computationally the temporal ordering patterns of Genette (1980). However, many challenges remain, including modal issues, habitual expressions, commonsense durations, and ceiling effects in automatic extraction of chronologies. Finally, the temporal representation was added to NarrativeML.

In Chapter 4, I provided an overview of a substantial body of work trying to formalize plot. Recent work has emphasized the representation of affect states, beliefs, and expectations of characters, which can be of considerable narratological interest in terms of grounding explanations of events. However, computational work has not yet addressed the practical issues of automation of such inferences in language understanding. I proposed a more viable summarization-oriented approach based on narrative event chains (NECs), which in turn was added to NarrativeML. I indicated how NEC-based summaries could be integrated with *Move*-grammars. To provide more expressiveness to the representation in terms of offering better explanations of motives, NEC-based summaries can also be augmented using domain-independent causal reasoning, as in the Choice of Plausible Alternatives (COPA) task. However, automatically producing summary NECs for a narrative requires further work on the computation of narrative distance and the weighting of protagonists and event types. No matter which plot models turn out to be most viable, they will need to be extended to better represent the goals of non-existent characters, as well as (especially to explain our intuitions about endings) the goals of narrators.

### 5.1.2 NarrativeML

NarrativeML, as we have seen, integrates narratological insights in a single annotation scheme, focusing on narrator perspective, distance, embedding, accessibility relations, audience response, time and tempo, character goals, and plot. To improve system inferences related to these concepts, I have indicated a number of computational issues that need to be addressed. To make all of these contributions realizable in current systems, one outstanding issue is the fact that many literary genres are long. This presents a problem for annotation. Models of time and plot will need to apply to *scenes* or *episodes* (provided or computed) rather than just events. Representative events will need to be selected to project to such higher-level segments.

The final form of NarrativeML is as follows:

**Example 5.1**

```
<?xml version='1.0'?>
<!DOCTYPE NarrativeML [

<!ELEMENT NarrativeML (#PCDATA | NARRATIVE)*>
<!ATTLIST NarrativeML xsi:noNamespaceSchemaLocation CDATA #IMPLIED>
<!ATTLIST NarrativeML xmlns:xsi CDATA #IMPLIED>
<!ATTLIST NarrativeML version CDATA #IMPLIED>

<!ELEMENT NARRATIVE (#PCDATA | NARRATOR | AUDIENCE | CHARACTER |
 EVENT | TIME | PLACE | TLINK | SLINK | EVALUATION |
 GOAL | TEMPO | NEC)*>
<!ATTLIST NARRATIVE id ID #REQUIRED>
<!ATTLIST NARRATIVE parent IDREF #IMPLIED>
<!ATTLIST NARRATIVE title CDATA #IMPLIED>
```

```
<!ATTLIST NARRATIVE level CDATA #REQUIRED>

<!ELEMENT NARRATOR (#PCDATA)>
<!ATTLIST NARRATOR id ID #REQUIRED>
<!ATTLIST NARRATOR coref IDREF #IMPLIED>
<!ATTLIST NARRATOR exists (true | false) #IMPLIED>
<!ATTLIST NARRATOR accessibleTo IDREFS #IMPLIED>
<!ATTLIST NARRATOR name CDATA #IMPLIED>
<!ATTLIST NARRATOR form CDATA #IMPLIED>
<!ATTLIST NARRATOR order (ACHRONY | ANALEPSIS | CHRONICLE |
    PROLEPSIS | RETROGRADE | SYLLEPSIS | ZIGZAG) #IMPLIED>
<!ATTLIST NARRATOR distance (NARRATED | INDIRECT | FREE_INDIRECT
 | REPORTED | DIRECT | IMMEDIATE) #IMPLIED>
<!ATTLIST NARRATOR perspective (NON_FOCALIZED | INTERNALLY_FOCALIZED |
   EXTERNALLY_FOCALIZED | OTHER) #IMPLIED>
 <!ATTLIST NARRATOR timeRelation (SUBSEQUENT | SIMULTANEOUS
  | PRIOR) #IMPLIED>
 <!ATTLIST NARRATOR  speechTime IDREF #IMPLIED>
 <!ATTLIST NARRATOR  person CDATA #IMPLIED>

<!ELEMENT AUDIENCE EMPTY>
<!ATTLIST AUDIENCE id ID #REQUIRED>
<!ATTLIST AUDIENCE coref IDREF #IMPLIED>
<!ATTLIST AUDIENCE name CDATA #IMPLIED>
<!ATTLIST AUDIENCE form CDATA #IMPLIED>

<!ELEMENT CHARACTER (#PCDATA)>
<!ATTLIST CHARACTER id ID #REQUIRED>
<!ATTLIST CHARACTER coref IDREF #IMPLIED>
<!ATTLIST CHARACTER exists (true | false) #IMPLIED>
<!ATTLIST CHARACTER accessibleTo IDREFS #IMPLIED>
<!ATTLIST CHARACTER name CDATA #IMPLIED>
<!ATTLIST CHARACTER form CDATA #IMPLIED>
<!ATTLIST CHARACTER attributes CDATA #IMPLIED>

<!ELEMENT GOAL EMPTY>
<!ATTLIST  GOAL id ID #REQUIRED>
<!ATTLIST GOAL parent IDREF #IMPLIED>
<!ATTLIST  GOAL  leaf (true | false) #REQUIRED>
```

```
<!ATTLIST  GOAL  type (Move | Problem | Auxiliary
  | Solution) #REQUIRED>

<!ELEMENT EVENT (#PCDATA)>
<!ATTLIST EVENT id ID #REQUIRED>
<!ATTLIST EVENT coref IDREF #IMPLIED>
<!ATTLIST EVENT exists (true | false) #IMPLIED>
<!ATTLIST EVENT type (ACTION | SPEECHACT | PERCEPTION
  | MENTAL) #IMPLIED>
<!ATTLIST EVENT goal IDREF #IMPLIED>
<!ATTLIST EVENT duration NMTOKEN #IMPLIED>

<!ELEMENT TIME (#PCDATA)>
<!ATTLIST TIME id ID #REQUIRED>
<!ATTLIST TIME coref IDREF #IMPLIED>
<!ATTLIST TIME accessibleTo IDREFS #IMPLIED>
<!ATTLIST TIME value NMTOKEN #IMPLIED>
<!ATTLIST TIME beginPoint IDREF #IMPLIED>
<!ATTLIST TIME endPoint IDREF #IMPLIED>

<!ELEMENT TEMPO EMPTY>
<!ATTLIST TEMPO storyTime NMTOKEN #IMPLIED>
<!ATTLIST TEMPO readingLength NMTOKEN #IMPLIED>

<!ELEMENT PLACE (#PCDATA)>
<!ATTLIST PLACE id ID #REQUIRED>
<!ATTLIST PLACE coref IDREF #IMPLIED>
<!ATTLIST PLACE exists (true | false) #IMPLIED>
<!ATTLIST PLACE accessibleTo IDREFS #IMPLIED>

<!ELEMENT TLINK EMPTY>
<!ATTLIST TLINK id ID #REQUIRED>
<!ATTLIST TLINK type (SIMULTANEOUS | BEFORE |  IMM_BEFORE | OVERLAPS
  | BEGINS | ENDS | INCLUDES) #REQUIRED>
<!ATTLIST TLINK eventID IDREF #IMPLIED>
<!ATTLIST TLINK timeID IDREF #IMPLIED>
<!ATTLIST TLINK relatedToEvent IDREF #IMPLIED>
<!ATTLIST TLINK relatedToTime IDREF #IMPLIED>
```

```
<!ELEMENT SLINK EMPTY>
<!ATTLIST SLINK id ID #REQUIRED>
<!ATTLIST SLINK eventID  IDREF #REQUIRED>
<!ATTLIST SLINK subordinatedEventID  IDREF #REQUIRED>

<!ELEMENT EVALUATION EMPTY>
<!ATTLIST  EVALUATION id ID #REQUIRED>
<!ATTLIST  EVALUATION eventID  IDREF #REQUIRED>
<!ATTLIST  EVALUATION characterID  IDREF #REQUIRED>
<!ATTLIST  EVALUATION audienceID  IDREF #REQUIRED>
<!ATTLIST  EVALUATION  value (1 | 2) #IMPLIED>
<!ATTLIST  EVALUATION  polarity (positive | negative | neutral)
  #IMPLIED>

<!ELEMENT NEC EMPTY>
<!ATTLIST NEC id ID #REQUIRED>
<!ATTLIST NEC entity IDREF #IMPLIED>
<!ATTLIST NEC events IDREFS #IMPLIED>

]>
```

### 5.1.3 NARRATOLOGICAL REFLECTIONS

Before concluding this section, I would like to offer the reader who has journeyed this far some insights on the relationship between humanities narratology and computational approaches. As I have argued elsewhere in Mani (2012), computational approaches have largely imported narratological theories that emphasize formal and/or logical structure, mapping narratological constructs to computational representations and illuminating interactions among them. The flow of influences has historically been from narratolology to computation. It is reasonable to expect such a flow to continue; for example, more elaborate narratological theories of character psychology, perhaps coming out of cognitive narratology, may be of considerable interest to computational approaches. As for the largely one-way direction of the flow, it is worth singling out some notable exceptions: (i) scripts, which continue to arouse narratological interest (but are only of marginal interest in computational approaches today, with their closest equivalent being narrative event chains); and (ii) plot units, which have been discussed and elaborated by narratologists including Ryan (1991). One reason for a sluggish flow in the opposite direction may be attributed to the fact, alluded to earlier in Chapter 2, of the narratologist's focus on narrative discourse rather than fabula, and on form rather than content. Another reason may be that systems for narrative generation, in particular, have not been general enough to produce anything more sophisticated "than very short, relatively simple stories (such as fairy tales), let alone epics or novels" as Gervás et al. (2006) point out.

However, with the vast inroads made by text search, mining, and even translation tools, with their impact felt in every aspect of daily life, that relationship is likely to change. The transformation will not be in terms of computational formalisms supplanting or strongly influencing narratological theory. Rather, the relationship will be one where intelligent computer-assisted approaches that go well beyond today's corpus linguistics become dominant in humanities narratology.

## 5.2 FUTURE DIRECTIONS

Based on the concepts developed so far, it is worthwhile considering an architecture for narrative computing applications, shown in Figure 5.1.

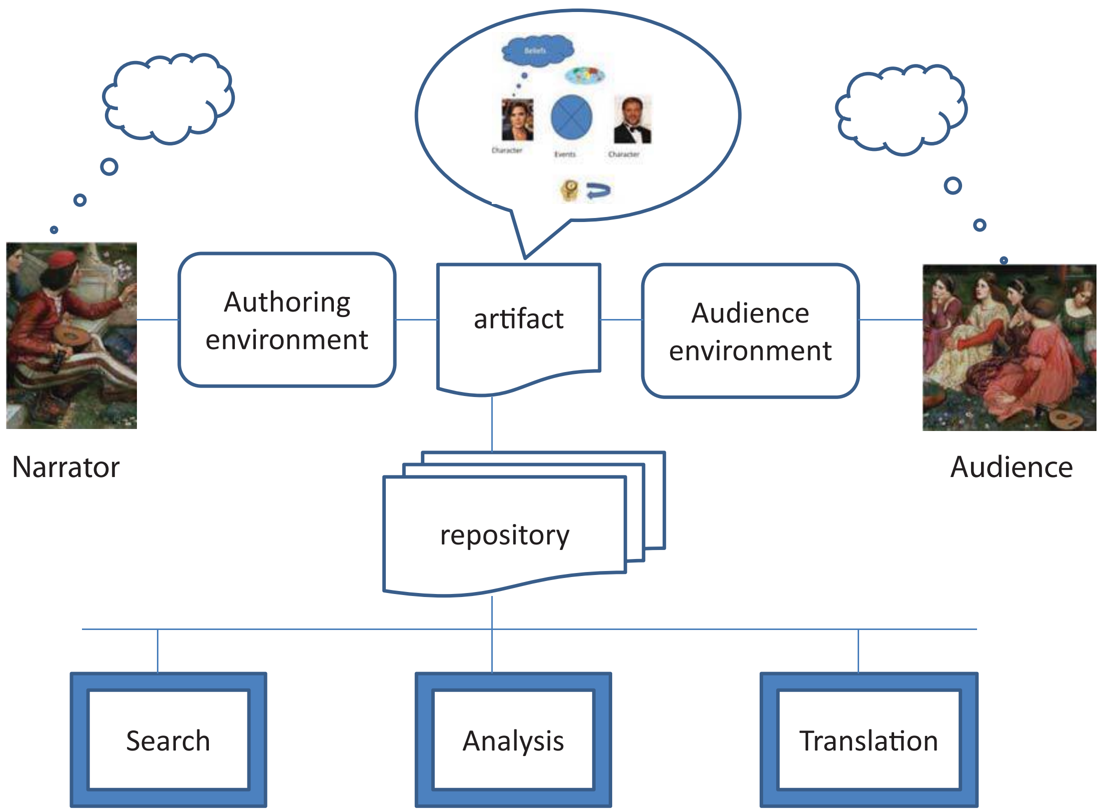


**Figure 5.1:** Narrative Computing Applications.

As can be seen, tools can be developed to support improved authoring environments, as well as better interactions with the audience. Narratological analyses of artifacts can be represented at different levels in repositories, which can be mined to support enhanced search, analysis, and translation.

Thus, in retrieving stories, as illustrated in Chapter 4 in the case of *The Wily Lion* compared with *The Fox and the Crow*, stories from an annotated corpus that exhibit similar character plans can be clustered together automatically. These comparisons in turn can address the classic narratological question of what it means for narratives to have a common plot. For generating stories, a story plan could be checked to see if it is feasible, and the tempo of a story might be monitored automatically to reveal crucial plot-related inflexion points, as shown in the case of *The Wily Lion* in Chapter 3. In both understanding and generation, comparison of properties of temporal subgraphs associated with particular characters can reveal interesting contrasts in character behaviors, as shown in the case of *The Travelers and the Bear* in Chapter 3.

It should also be possible to automatically flag stories for literary magazines, recommending in advance which ones to banish to the so-called slush heap, by leveraging a corpus of stories submitted to versus accepted by a magazine during a particular period. This problem is related to those of essay grading by Valenti et al. (2003) and sentiment analysis, e.g., work by Pang et al. (2002), both of which areas have shown good progress. (Obviously, allowance will have to be made for creative stories that innovate by subverting established norms.)

In interacting with the audience, improved reading and visualization environments might be developed (in some cases, leveraging dedicated book-reading devices), along with various checklists of narratological concepts that consumers might find interesting (an analogue of today's book discussion points). Or else, a system might expose a variety of interaction points via plans that accommodate user interaction, or it might switch on an audience simulator.

Once a wider range of narrative artifacts (short stories, novels, plays, interactive games, etc.) have been annotated to create more balanced narrative corpora, these can be used to train systems to analyze larger datasets, bootstrapping the systems to build vast repositories. These repositories can then be searched, mined, and translated, providing far more advanced search capabilities than the "Look Inside" book inspections offered by today's search engines.

For example, specialized literary search engines could go well beyond today's plagiarism detectors to find automatically annotated text snippets that match narratological criteria for a particular type of dialogue or plot. Sometimes the retrieval results (especially those which pertain to the inferred beliefs and motives of agents) may offer a different interpretation from the user's; this can in turn provide healthy fodder for narratological discussion. Literary thesauri might also be useful, to suggest corpus-derived related terms for describing a character, a scene, etc. These could be deployed in both authoring as well as in narratological studies. Given a plethora of online narratives, where everyone authors 'literature', it will be critical to be able to automatically cluster literary works that reflect a community of interest. Finally, literary artifacts could some day be translated automatically while leveraging existing translations as training data, as well as translated by humans using translation memory databases of previous translations. Early steps toward such a grand project were taken more than a decade ago, in work on discovering paraphrases in multiple translations of a source text by Barzilay and McKeown (2001) for *Madame Bovary* (see also Barzilay and Lee (2003)).

Mining of vast narrative repositories can make possible a discipline of corpus narratology that provides much richer and larger-scale hypothesis testing and data exploration than has been possible to date. We have already examined, in Chapter 3, the capability to extract temporal graphs for narratives, illustrating the patterns of Genette (1980). Interesting recent developments include the work of Elson et al. (2010), who automatically tag quoted speech (an aspect of narrative distance), attributing each quote to a character, and building a graph marking length of conversations between pairs of character entities in 19th century novels. Their automatic detection and analysis of such conversational social networks provides evidence against a claim by the literary critic Moretti (1999) that there is an inverse correlation between the amount of dialogue and number of characters in 19th century novels. These and similar computational methods have the potential to considerably advance the progress of narrative theory.

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# Author's Biography

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**Inderjeet Mani**, who currently volunteers with the Children's Organization of Southeast Asia, was formerly a Visiting Scholar at the Department of Computer Science, Brandeis University, a Senior Principal Scientist at The MITRE Corporation, a Visiting Fellow at the Computer Laboratory at the University of Cambridge, and an Associate Professor at the Department of Linguistics at Georgetown University. He has served on the editorial boards of *Computational Linguistics* and *Natural Language Engineering*, and has published over 90 peer-reviewed papers, and seven books, including *The Imagined Moment* (University of Nebraska Press, 2010), a work on time, narrative, and computation that is addressed to a non-specialist audience. He has also published numerous short stories. More details can be found at `http://tinyurl.com/inderjeetmani`.

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