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## RESEARCH ARTICLE

# An architecture of narrative memory



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Script

### Abstract

Narrative is ubiquitous. According to some models, this is due to the hypothesis that narrative is not only a successful way of communication, but a specific way of structuring knowledge. While most cognitive architectures acknowledge the importance of narrative, they usually do so from a functional point of view and not as a fundamental way of storing material in memory. The presented approach takes one step further towards the inclusion of narrative-aware structures in general cognitive architectures. In particular, the presented architecture studies how episodic memory and procedures in semantic memory can be redefined in terms of narrative structures. A formal definition of narrative for cognition and its constituents are presented, and the functions that an implementation of the architecture needs are described. The relative merits and the potential benefits with regard to general cognitive architectures are discussed and exemplified.

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## Introduction

Narrative phenomena are essentially ubiquitous. All societies and in general all members of these societies can produce and understand narratives naturally. Several authors defend the thesis that human cognition and narrative are tightly related. Schank and Abelson, for instance claim that narrative is not just an activity or a sophisticated form of communication, but a concrete underlying topology of memory (Schank & Abelson, 1977). Herman (2002), for

instance, proposes a *Story Logic* in which instead of identifying narrative with stories, it is considered as a full logic, a way of reasoning on experience. Bruner takes one step beyond, arguing that experience and memory happen “in the form of narrative”, leveraging the role of narrative way beyond literary aspects (Bruner, 1991). Szilas defends this idea, which he calls the **narrative hypothesis** (Szilas, 2015). He does so by remarking that, despite criticism (Ryan & Ryan, 2010), narrative happens *with* narrative-related cognitive processes (emotions or chronological ordering). This narrative hypothesis is assumed all through this paper, and it is used as scaffolding to build the presented cognitive architecture of narrative knowledge.

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This work does not dig into the physiological aspects causing narrative behavior, not it does into the source of this phenomenon. Whether narrative happens in cognition because of learning or because of innate capabilities is, from the point of view of the functional description of the average human cognition, not strictly relevant. This work focuses on the implications of the hypothetical narrative characteristics of some functions of human cognition and not on what produces them. This narrative hypothesis has strong implications in the way we understand cognition in humans, and as such a cognitive architecture accepting it must describe its components including narrative properties not only with additional modules, but as an in-depth review of the functional characteristics of more general aspects of memory and processing.

To the best of our knowledge, a general architecture for narrative cognition has not been yet proposed. This is probably due a number of issues. The fact that narrative behavior is certainly complex and many times assumed to be a literary phenomenon puts it away from the focus of general cognition. Besides, achieving shallow narrative behavior is doable without explicit models of narrative, since procedural information about how to build a useful story is probably enough for most practical cases.

However, given the recent advances of cognitive architectures and the growing interest on narrative and its relation to general cognition, proposing an architecture for narrative cognition can be relevant and useful in general as a first step towards the study of the working hypothesis, and its influence on practical architectures both for Cognitive Science and Artificial Intelligence.

Most modern cognitive architectures are complex enough as to consider different types of memory. This paper only addresses two main parts of explicit memory, namely *episodic* and *semantic*. This is due to practical and theoretical aspects. First, analyzing the narrative properties all proposed kinds of memory would require a more extensive work, outside reasonable scope. Second, it is unlikely that all cognitive models of memory present narrative aspects, at least as they are conceived in this paper. Therefore, it has been considered illustrative and useful to propose a model of narrative cognition restricted to two main, generally accepted types of memory where, hypothetically, narrative properties can be clearly observed.

The current proposal makes no claims about the applicability of the proposed solution to other domains, for instance, non-narrative messages. However, it is hypothesized that some features of this architecture could be adapted to fit other non-narrative sources of information, as discussed in Section 'Conclusions and future work'.

This paper is organized as follows: Section 'Definition of narratives for the cognitive architecture' proposes a formal definition of narratives suitable as a unit of information in the narrative memory and Section 'Representation of narratives as cognitive objects' specifies the constituents of narrative objects. Section 'Episodic memory as a narrative memory' describes an architectural description of episodic memory as narrative memory, and Section 'Procedural—semantic memory and narrative' does the same for processes stored in semantic memory.

An overall architecture of narrative memory is described in Section 'Overall architecture of narrative memory', and

the corresponding examples are explained in Section 'Examples'. Sections 'Discussion' and 'Conclusions and future work' provide discussion and conclusions, respectively.

## Definition of narratives for the cognitive architecture

Along the years, several definitions of what a narrative is have been proposed. All of them have some aspects in common, but they in general depart from each other when the focus is set on literary aspects. This work, while not leaving literature and artistic behavior apart, is centered on a more general conceptualization of narrative, more in line with cognitive structures.

For the sake of this work, the definition of *narrative* proposed by Finlayson will be used (Finlayson & Corman, 2013). Briefly, this definition states that a narrative:

1. is a *sequence of events*,
2. that are *causally related*,
3. involving specific *characters* and *times*,
4. and displays a certain level of *organization* beyond the basic coherence.

The particular difference with regard to a plain sequence of events is made by point 4, which does actually highlight a fundamental property with regard to the proposed architecture. This account tries to describe the common activity of narrative behavior, and as such it identifies the particular characteristics that differentiate it from the simple description of an event list (which could also be a narrative).

The fact that narratives have a certain organization beyond pure coherence and order is what makes the definition useful for the proposed architecture that this work is about to describe. This organization is commonly assumed to happen at several levels both from the point of view of structure (discourse, content) and the cognitive effect (focus, salience, inference).

From here on, this study will be based on the assumption that:

- From a functional point of view, part of human cognition is structured with narrative properties.
- Narratives have certain properties that make them different from plain sequences of events.

## Representation of narratives as cognitive objects

While this architecture for narrative memory offers a framework and not a final implementation, it is relevant to describe the main properties that a narrative must address in order to be suitable for the model. This section proposes a formal definition of narrative information, while still leaving room for particular instantiations for specific implementations.

As previously pointed out in Section 'Definition of narratives for the cognitive architecture', the number of definitions of what constitutes a narrative is vast and some

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