# Desiderata for a Computational Model of Human Online Narrative Sensemaking

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## Abstract

Storytelling presents a compelling context for the development of intelligent systems. Increasingly, research on intelligent systems has targeted the development of computational models for the generation and understanding of stories. However, few projects include in their accounts components that reflect insight in to the narrative comprehension process provided by narratology and cognitive psychology. In this paper, we synthesize these relevant perspectives into desiderata for computationally modeling the narrative sensemaking process. We describe the set of requirements that process models ought to satisfy should they aim to define a computational procedure reflecting the human sensemaking processes, either in the production of narrative or in its automated understanding.

Storytelling is increasingly relied upon to entertain, educate, and engage American society in more compelling ways (Lenhart et al. 2008; Lohse et al. 2013; Duggan 2015). Driven by the increased demand to structure human interaction through stories and by the realization that artificial intelligence (AI) is well suited to doing so, the field of computational models of narrative (CMN) has progressed primarily on the two fronts that make up the **narrative intelligence** (Mateas and Sengers 1999) enterprise: computational narrative generation and computational narrative sensemaking (Mueller 2013). While distinct, these two areas are intrinsically related: the ultimate design criteria for a narrative artifact rests in the mind of the story consumer, and authors design the stories they tell to affect audiences in specific ways (Bordwell 1989; Sharples 1999). Thus, the field must advance these areas in tandem. Here, we focus on computational narrative sensemaking.

Within the field of CMN, sensemaking[1] has received the largest amount of attention in the literature to date; see the article by Mueller for a review of this work up until the year 2013. These systems have primarily tackled the challenges involved in understanding intuitively important narrative-theoretic concepts on the basis of sentential text; concepts include time, space, states, events, goals, plans, scripts, characters, and objects.



[1]Historically, these narrative sensemaking systems have been referred to as *story understanding* systems.

However, despite excellent work on developing computational models of narrative sensemaking, scholars – with notable exceptions – have not attempted to include in their accounts directly relevant perspectives from narratology and cognitive psychology. In this paper, we synthesize these relevant perspectives into desiderata for computationally modeling sensemaking. We describe the set of requirements that process models ought to satisfy should they aim to define a computational procedure that reflects or complements the human sensemaking processes conceptually described and empirically investigated by cognitive psychologists. We target modeling sensemaking in an *online* manner, *i.e.* during the consumption of the narrative.

Importantly, we do not claim that AI for narrative sensemaking that reasons like humans do should be prioritized to the exclusion of other potential kinds of intelligent systems. While people remain our only examples of naturally-occurring intelligent systems, there may exist many different psychologies that can be computationally characterized and may be relevant to different task environments (Doyle 1983).

## Operationalizing Narrative and Sensemaking

By proposing to use computationally-precise definitions, we are implicitly making an ontological commitment over the structure of narrative and associated phenomena. To avoid leaving our ontological commitments tacit, we explicitly outline them here.

### Narrative

The ontological nature of what constitutes a narrative is a subject of extensive debate within narratology (Herman 2004a; Meister 2014). The **structuralist** tradition (*e.g.*, Barthes 1975) within the field of narratology – which posits that human understanding of narrative is constructed by appealing to the context of larger structures that narratives are a part of (as opposed to an individual's interpretation of the literary work) – provides a useful point of departure for talking about narratives in a computational sense. This tradition typically distinguishes at least the following two ontological elements of a narrative:

1. The **fabula**,[2] a conceptualization of the narrative's underlying world, including the **characters**, **locations**,

[2]Alternatively: **story**, **plot**, **histoire**.

**actions**, and **happenings** it contains (Chatman 1980). The actions and happenings are logically and chronologically related; actions are events effected by actors and happenings are events experienced by them (Bal 1997). Characters are beings endowed with anthropomorphic traits and engaged in anthropomorphic actions (Prince 2003). Locations are the spatial character in which the events occur (Prince 2003). Events are a change of one state of affairs to another (Rimmon-Kenan 2002).

2. The **discourse**,[3] a temporal organization of a subset of events of the fabula. The discourse is composed of the communicative elements that participate in the narrative's telling, which implies a narrator who is performing an intentional act (*i.e.* executing a choice of what to narrate) to achieve a communicative goal (Genette 1980).

Modern accounts of narrative also distinguish a third element in the ontology:

3. The **narration**,[4] an act of physical or **surface-level realization** (Reiter and Dale 2000) of the discourse in some transmittable format. Common formats include oral, textual, cinematographic, and virtual.

For the purposes of this paper, we operationally define **narrative** as the product of a narration of a sequence of events that constitute a trajectory through states of affairs. Our operationalization's use of the word "narration" is meant to restrict the described events to ones that relate to a narrator's communicative goal, achieved through the surface-level realization of the narrator's discursive structure. This distinguishes narratives from, for example, a list of disconnected events, which have no "continuant subject" or "constitutive whole" (Chatman 1980). Further, the phrase "trajectory through states of affairs" is meant to rule out narratives where nothing happens; a narrative may begin and end at the same logical configuration as long as something happened in between.

Implicit in the above definition is our view of narrative as a communicative act between an author (who has the corresponding communicative goal) and their audience of story consumers. In this sense, there is an expectation of cooperation between author and audience, similar to the cooperative norms that exist between two people engaged in dialogue as described by the philosopher of language Grice in his **Cooperative Principle** (1957). According to Grice, when people engage in dialogue, they implicitly cooperate on the choice of what they say and how they say it in order to facilitate an effective exchange of meaning. The principle is summarized by Grice as a tacit contract between the participants of the dialogue, where all participants observe the following rule: "Make your conversational contribution such as is required, at the state at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged." (Grice 1975, p. 45). This rule summarizes the following four **Gricean Maxims of Conversation**, which govern the communicative contributions of participants engaged in conversation:

1. The **Maxim of Quantity**, where the contribution is neither more nor less than what is required.
2. The **Maxim of Quality**, where the contribution is genuine and not spurious.
3. The **Maxim of Relation**, where the contribution is contextually relevant to the ongoing communicative transaction.
4. The **Maxim of Manner**, where the contribution is unobfuscated.

In the case of narrative, the communicative channel that sets the context for the Cooperative Contract is, for the most part, unidirectional: from author to audience. The author is expected to abide by the Cooperative Principle when narrating to the audience. In fact, many literary devices rely upon this expectation for their effectiveness. For example, **Chekhov's Gun** (Rayfield 2000) is a literary device in which an author introduces an element of a fabula early in the narration, but waits to reveal the element's purpose until later in the discourse. This device relies on the Maxim of Relation: the author and the audience share the expectation that elements introduced into the story will ultimately demonstrate their relevance. Of course, an author can clearly take advantage of the audience's expectation by inserting elements to purposely mislead the audience; this is the literary device known as the **Red Herring** (Turco 1999).

## Sensemaking

As defined, a narrative can be created without appeal to a target story consumer. Typically, however, an author's communicative goal is expressible in terms of a cognitive state the author wishes to elicit in the mind of the story consumer (Bordwell 1989). Authors *design* the structure of their stories to affect audiences in specific ways (Sharples 1999). This design scaffolds a person's sensemaking of the narrative to the degree desired by the author.

The **reader-response** tradition (*e.g.*, Holland 1975) within the field of narratology grew in direct opposition to the structuralist tradition and provides a useful point of departure for talking about narrative sensemaking in a computational sense. This tradition posits that human understanding of narrative is constructed by appealing to the individual, who imparts "real existence" to a narrative work and completes its meaning by mentally enacting it through their own experience. This tradition also fomented the perspective that narratives can be used as a framework for understanding the world around us (Bruner 1991); our cognitive faculties allow us to impose a narrative structure to our environment, helping us organize our experiences without regard to an explicitly authored structure. In essence, humans are "wired for story" (Boyd 2009).

While it certainly is useful to think about narrative sensemaking in the absence of structure, our work here concerns sensemaking in the context of narratives that are designed for some communicative purpose. As such, it represents a synthesis between the antithetical perspectives of structuralism and reader-response. The objective is the computational study of a person's cognition with respect

[3] Alternatively: **syuzhet**, **discours**, **récit**.

[4] Alternatively: **text**, **media**, **medium**.

to intentionally designed narratives; in narratological terms, the work here attempts to posit requirements for the modeling of a phenomenon that is of central concern to reader-response theorists through the representation and manipulation of structures of central concern to structuralists. The view of sensemaking by Gernsbacher, Verner, and Faust (1990) is useful for this endeavor; they described a narrative as a set of instructions, which allow someone to reconstruct a situation. This description takes a **constructivist** stance, which echoes the reader-response tradition: that story consumers construct meaning out of their experience and mentally-represented ideas. A key component of this narrative reasoning is the construction of the narrative's described **situation models**. A situation model is a kind of **mental model** (Johnson-Laird 1983) that a story consumer forms from an amalgamation of information explicitly described in, as well as information inferable from, a narrative. The set of instructions that Gernsbacher, Verner, and Faust refer to is the narration that is intentionally designed by the author for some communicative goal. We take the view of **writing as design** (Sharples 1999) in which the authoring of a narrative artifact is framed as an instance of the more general problem of artifact design (*cf.* Norman 2002), the objective of which is the successful elicitation of the designer's mental model of the artifact's operation. In the case of narrative, we posit that the mental model that a designer wishes to transmit is a subset of the narrative's fabula. Thus, **sensemaking** is operationally defined as the process through which a story consumer mentally constructs the situation models that represent a subset of a fabula through the perception of a narrated artifact.

Two things are worth noting about this definition. First, we restrict our discussion here to contexts where there is a narrative artifact to perceive. At first glance, this may seem antithetical to the reader-response tradition; this tradition holds that there need not be an explicit narrative artifact for people to engage in narrative reasoning. We adopt here the perspective that narrative sensemaking *requires* a narrative artifact, whether explicitly narrated in some medium (as in our operational definition of narrative) or mentally imposed by the person through the adoption of a **narrative construal** (Bruner 1991), an abstract mode of thinking which facilitates viewing entities through a metaphorical narrative lens in order to interpret them against archetypal narrative structure (Fisher 1985).[5] Thus, sensemaking is a process that operates independent of the author's intent, but the author intentionally selects a discursive structure that affords greater or lesser understanding of a story, depending on what is needed to achieve their communicative goal. Second, this definition of sensemaking does not rule out that a constructed fabula's structure can change over the course of the narrative's perception. Viewed from a reader-response perspective, narration (as defined earlier within the structuralist tradition) can be construed as the guided evolution of a person's construction of a fabula. As sensemaking continues, the shape of the fabula in the mind of the story consumer will change.

[5]The adoption of such a construal is itself a cognitive process that is beyond the scope of what we aim to computationally model here.

## Desiderata for Modeling Sensemaking

Sensemaking itself involves several cognitive faculties, but minimally it involves mental model formation (Graesser, Olde, and Klettke 2002) and there is evidence to suggest that it is medium-independent (Gernsbacher, Verner, and Faust 1990). How human narrative sensemaking works at a *process* level is still the subject of debate within narratology and cognitive psychology and is what the present paper aims to take steps toward establishing. There are several consistent perspectives with widespread empirical support that offer insight into how we might model such a process. Collectively, these perspectives constitute the desiderata that we claim computational models ought to either satisfy or control for if they purport to model human narrative sensemaking. The perspectives we highlight can be grouped into two categories: *representational* and *reasoning*.

### Representational Perspectives

**Propositional mental models** (Johnson-Laird 1980) were proposed as a better alternative to *images* as mental representations; the former is more parsimonious, affords greater functional capacity, and is more expressive than the latter. A propositional representation is discrete and digital. Propositions are abstract: they are a symbolic interlingua for reasoning and can be treated as a function that "takes a state of affairs (perceived, remembered, or imaginal) as an argument, and whose body is capable of returning a truth value." (Johnson-Laird 1980, p. 96).

There are **three levels of encoding** that story consumers use during sensemaking (Van Dijk and Kintsch 1983; Schmalhofer and Glavanov 1986; Zwaan and Radvansky 1998). We refer to them as the medium, discourse, and fabula levels of encoding.[6] Van Dijk and Kintsch (1983) argue that just as linguistics distinguishes between meaning and reference, discourse theories should distinguish between the representation of a text and the representation of the situations which are described in the text.

The **Event-indexing Model** (Zwaan, Langston, and Graesser 1995) posits that as people consume a narrative, they mentally represent its constituent event structure; this event structure represents the fabula. Each event itself is defined by the "chunking" together of (at least) five dimensions of information: (a) a **time** frame, (b) a **space** frame, (c) a **causal** relation to other events; one of four: enablement, motivational causation, psychological causation, or physical causation (Trabasso and Sperry 1985), (d) an **intentional** relation to other events, and (e) the set of **entities** (characters and objects) that are engaged in some

[6]Confusingly, there is no agreed-upon terminology for these three levels. They have been summarized as the two levels "textual and situational" by Van Dijk and Kintsch, referred to as "verbatim, propositional, and situational" by Schmalhofer and Glavanov, and as "surface structure, text base, and situation model" by Zwaan and Radvansky.

activity. A situation model index is a property of the event. The model makes verified general predictions with respect to the availability for cognitive processing (*i.e.* recallability or capacity for salience) of a previously perceived – a target – event given a cue on the basis of the degree of overlap between the target and the cue in terms of situation model indices; it makes no commitment regarding which situation model indices prove to be stronger predictors of recall (Zwaan 1999). Intuitively, the dimensions cover the journalistic 5W1H questions[7]. Further, as people consume a narrative, they mentally represent its discourse (*i.e.* the "text base") and its surface encoding (Schmalhofer and Glavanov 1986). The structure of such an encoding is a subject of ongoing debate, but there is evidence to suggest that it directly impacts the situation model encoding of the fabula (*e.g.* Kraft 1986, Cutting 2016) and is grammatical in nature (Cutting 2016; Cohn 2018).

## Reasoning Perspectives

**Event segmentation theory** (Zacks and Swallow 2007) covers a wide collection of research on the human perception of ongoing action. Zacks, Speer, and Reynolds (2009, p. 308) characterize it as a "computationally and neurophysiologically explicit account of event structure perception." The theory posits that continuous streams of incoming information are segmented into a series of discrete units. This **event segmentation** process typically occurs around verb phrases in written text (Zwaan, Magliano, and Graesser 1995) and on the basis of goal-driven character actions in film (Zacks, Speer, and Reynolds 2009). Specifically, the segmentation is driven by **continuity prediction failures** along the aforementioned event-indexing model dimensions (Radvansky and Zacks 2011). Humans naturalistically infer information on the basis of presented information; when we fail to predict continuity in terms of any of the event indices, that is a cue to the mind to segment the incoming stream into a new event.

The **Situation Model General Processing Framework** (Zwaan and Radvansky 1998) makes a commitment to three organizational levels of event processing in the context of Ericsson and Kintsch's (1995) conceptualization of Short-Term Working Memory (STWM) and Long-Term Working Memory (LTWM). Zwaan and Radvansky (1998, p. 166) point out that:

> It is possible in highly practiced and skilled activities, such as language comprehension, to extend the fixed capacity of the general short-term working memory (STWM) system by efficiently storing information in long-term memory and keeping this information accessible for further processing. This expansion of STWM is called long-term working memory (LTWM) and corresponds to the accessible parts of a previously constructed mental representation in long-term memory.

When an event is perceived, a situation model of that event is built on the basis of the (Event-indexing Model's) dimensions of information; this is referred to as the **current situation model**, Zwaan and Radvansky's first organizational level and their representation of STWM. All previously perceived events are assembled in the **integrated situation model**, their second organizational level and representation of LTWM. The current situation model is what serves as a cue to events in the integrated situation model. The integrated situation model is the global model that is constructed by integrating (one at a time) the current situation models as they were created, a process Zwaan and Radvansky refer to as **updating**. The third organizational level, referred to as the **complete situation model** is the model stored in long-term memory after all story content has been consumed. The complete situation model need not be the final one; consumers may ruminate and generate additional inferences or develop new models altogether (a common practice in literary studies). Recent evidence by Zacks, Bailey, and Kurby (2018) supports the idea that humans naturalistically engage in updating both at a **local and global level**. In other words, consumers reason about coherence of the current situation model relative to the integrated model as well as the complete situation model.

A previously-perceived target event's recallability during sensemaking depends conceptually on the relationship between a cue event (which prompts foregrounding) and the target event. Under the Event-indexing Model, this relationship is characterized in terms of the situation model index values that are shared between the cue and the target. The **Event-horizon Model** (Radvansky 2012) also calls attention to the fan effect, or the spreading activation of transient memory for related narrative events. The fan effect has two primary manifestations:

1. **Competitive memory retrieval**, which occurs when there is a significant amount of overlap between a memory cue and previously experienced events in the narrative. Due to the amount of overlap, memory for any individual event (including the event that is being recalled) is impoverished. As an example, if you were to try to remember a specific instance when you last used your credit card, it would be difficult to do so because of the relative commonness of the event (assuming you are a big spender).
2. **Non-competitive memory retrieval**, which occurs when there is little overlap between a memory cue and previously experienced events in the narrative. Due to the amount of overlap, memory for any individual event is improved, due to the uniqueness of the event dimensions. As an example, if you were to try to recall a specific instance when you changed your bicycle chain, it would be easy to do so because of the relative uniqueness of the event (assuming you do not work at a bicycle repair shop).

The Event-horizon Model *does* make a commitment to which situation model indices are stronger predictors of recall, placing primacy on the causal dimension of reasoning.

[7]These questions are: What happened? Who was involved? Where did it take place? When did it take place? Why did that happen? How did it happen?

The integrated mental representation that a story consumer assembles on the basis of perceived information is **queryable**, as the QUEST Model (Graesser and Franklin 1990) has evidenced. This model assumes that semantic content exists in the mind as an information source called a QUEST knowledge structure, a directed graph which is manipulated symbolically to return normative answers to specific queries. The queries under consideration parallel the aforementioned journalistic questions, whose normative answers are constructed in QUEST through graph search and constraint satisfaction procedures.

Gerrig and Bernardo (1994) posit that as people consume stories, they mentally project themselves into them and are actively engaged in a **problem-solving** process centered on solving the puzzles, challenges, or dilemmas faced by the characters of the fabula.

Herman (2013) argues that a consumer's inferencing of un-narrated portions of a narrative is key to their comprehension. Herman draws upon the work by Dennett (1989), who argues that we have three broad construals with which we perceive, comprehend, and interpret the behavior of entities in our environment. These construals are organized in increasing levels of abstraction, and are obtained by adopting **stances**, intellectual strategies that mentally fabricate frameworks for understanding. The three stances (and corresponding construals) are: (a) the **physical** stance, wherein we explain an entity's behavior in terms of its physical constitution (*e.g.* mass, energy, velocity) to predict a future state given a present state, (b) the **design** stance, wherein we explain an entity's behavior on the basis of knowledge of the purpose and function of its design, without necessarily regarding its physical constitution, and (c) the **intentional** stance, wherein we explain an entity's (typically, software and minds) by appealing to the entity's encoded beliefs, desires, and intentions (BDI), without necessarily regarding the entity's physical constitution or design. As Dennett (1989, p. 17) writes:

> Here is how it works: first you decide to treat the object whose behavior is to be predicted as a rational agent; then you figure out what desires it ought to have, on the same considerations, and finally you predict that this rational agent will act to further its goals in light of its beliefs. A little practical reasoning from the chosen set of beliefs and desires will in most instances yield a decision about what the agent ought to do; that is what you predict the agent will do.

Adopting a stance is a flexible process; we can switch to a different stance if it helps diagnose a prediction error of a stance we have previously used. Dennett argues that understanding human behavior is by default at the intentional construal, but in general, knowing when to adopt/switch a stance is itself an open question and likely a function of the context/task itself. Herman (2013) reviewed converging evidence in cognitive psychology and narratology that support the idea that, **story consumers operate with the intentional stance by default**, where we are concerned with BDI to explain behavior. The behavior we are trying to explain, however, is not that of the narrative as an entity *per se*, but rather that of the author through the story itself. This explanatory process is driven by inferences the story consumer effects about why the narrative presents particular discourse that portrays particular fabula:

> In turn, the protocols that enable interpreters to use textual[8] patterns to explore storyworlds depend on inferences about communicative intentions. At issue is how readers of print narratives, interlocutors in face-to-face discourse, and viewers of films use (sequentially presented) constellations of semiotic cues to build narrative worlds. Relevant intention-oriented protocols come into play when interpreters provisionally assign a given narrative to the category of fiction or nonfiction, make further discriminations among genres and subgenres, and, using the affordances of a particular medium, provisionally ascribe to tellers the intention to prompt inferences about the structure, inhabitants, and spatiotemporal situation of the world or worlds in question. Herman (2013, p. 43)

Inferencing is a key part of narrative sensemaking (Magliano, Djikstra, and Zwaan 1996). While there is some debate as to the degree and extent to which story consumers construct inferences (*c.f.* McKoon and Ratcliff Graesser, Singer, and Trabasso 1994), cognitive psychologists generally agree that we construct at least two kinds of inferences during comprehension. The first (and more common) type of inference is termed a **bridging inference**, wherein a story consumer infers plot content that *must have occurred* between two utterances of the narrative's discourse. For example, consider the following sequence of discourse content:

(1) There was a boy named Jim.
(2) Jim wanted to eat a marshmallow.
(3) He lit a fire,
(4) but the surrounding brush was not cleared!
(5) Jim quickly put out the fire.
(6) Then he cleared the brush out of the way.
(7) He relit the fire,
(8) and roasted his marshmallow.
(9) He ate his marshmallow.

Adapted from Niehaus and Young (2014).

As each sentence is consumed, a situation model is formed; in the example above, sentence 5 is consumed, a situation model is created for which no causal antecedent model has been created. In order to make sense of the situation the text depicts, a consumer must bridge the (conceptual) gap between the previous sentence and the one they have just read. Thus, they construct the bridging inference (a situation model representing) that "the brush caught fire." By comparison, **elaborative inferences** are constructed when a story consumer infers plot content that *will subsequently occur* after a narrated utterance of the discourse. For

[8] Herman's use of the term "textual" here denotes the respective symbols in the discursive medium (*e.g.* text for books, visuals for film), as opposed to exclusively denoting script markings. An equivalent term would be "surface structure" as mentioned earlier.

example, consider the following sequence of discourse content:

(1) Jim sat down at the restaurant.
(2) He then received the menu from the waiter.
(3) After, Jim decided what he wanted.

Adapted from Schank and Abelson (1975).

When a reader consumes sentence 3, she may be prompted to construct and passively maintain a situation model for an event that seems natural to follow from the narrated events. Thus, she may construct the elaborative inference that "Jim ordered food from the waiter." While consumers routinely construct elaborative inferences, these inferences: (a) happen less often than bridging inferences because elaborations are not necessary for sensemaking (Magliano, Djikstra, and Zwaan 1996), (b) are typically not very detailed (McKoon and Ratcliff 1986), and (c) depend on internalized **script-like** knowledge (Schank and Abelson 1975), which represent what the inferences are about (Zwaan and Radvansky 1998).

### Conceptual Model and Desiderata

Figure 1 presents an illustration of the conceptual model of narrative sensemaking that we propose: an author designs both a fabula and its discourse, and this discourse is narrated in some medium to create a narrative artifact. The narrative encodes a sequential narration of events that represent a discourse structure. A story consumer uses their sensemaking faculties to attempt to mentally construct the fabula on the basis of what is consumed. Narrative sensemaking faculties should minimally involve the aforementioned perspectives, summarized as:

(1) being composed of or supporting a propositional representation;
(2) supporting three levels of encoding: the surface code, a discourse model, and a situation model;
(3) supporting the story consumer's creation and management of event structures, including:
    (a) the segmentation of the narrative discourse stream into event structure,
    (b) the construction of an event-indexing model of the fabula, and
    (c) the tracking of three event structures over the course of narrative consumption: the current, integrated, and complete situation models;
(4) anticipating and supporting inferences and/or computation over event structures, including:
    (a) the local and global updating of situation models,
    (b) the fan effect;
(5) supporting the ability to seek answers to the journalistic 5W1H questions provided in the fabula;
(6) supporting the process of readers acting as solvers of problems posed by the plot during the process of comprehension;
(7) facilitating the attribution of intent to the author's structuring of the discourse in order to understand and anticipate elements of the fabula; and
(8) allowing readers to naturalistically form bridging and elaborative inferences during sensemaking.

Scholars interested in modeling human online narrative sensemaking ought to account for each desideratum.

## Conclusion

While we have focused wholly on computational narrative sensemaking, we began by arguing that narrative generation and sensemaking are intrinsically related. Within the field of CMN, there is growing recognition that representations and algorithms employed for narrative generation – which predominantly focus on the structural elements of a narrative's fabula – are too limited in the **expressive range** (Smith and Whitehead 2010) of story structures they produce. We posit that this is due to the CMN field's collective lack of recognition that storytelling is a **communicative act**. Structural aspects of stories (*e.g.* events, characters) drive principal aspects of a consumer's sensemaking, but narrative scholars have been adamant that stories and their communication cannot ever be truly separate (Herman 2004b); the characteristics of the discourse determine the resources available to tell stories in a particular medium. As a result, generators continue to operate independent of a consumer's cognitive reasoning and thus continue to be at risk of generating *ineffectual narratives*; narratives that contain incoherent character behavior, communicate too much, or do not interestingly manipulate the audience's understanding for narrative effect. By accounting for the presented desiderata as part of a narrative generation system, we believe we can ameliorate these issues, afford a wider expressive range for the output stories, and target the generation of ecologically valid stories.

The ultimate aim of our research is to leverage computationally precise descriptions of sensemaking (which ought to account for our outlined desiderata) as the targets of an intelligent narrative generation system. We believe this is realizable by extending one paradigm for computational narrative generation: **narratives as plans** (Young et al. 2013); several state-of-the-art systems (*e.g.* Ramirez and Bulitko 2015, Teutenberg and Porteous 2015, Hayton et al. 2017, Shirvani, Ware, and Farrell 2017) have relied on plan-based knowledge representation and reasoning mechanisms for modeling stories and the discourse about them. This paradigm is well-suited to reasoning over the causal, temporal, and hierarchical relationships between events in a narrative's plot and has proven to be an effective method for modeling natural language generation in general (Garoufi 2014) that relies on framing utterances as **speech actions** (Austin 1955) and treating communication as a goal-oriented process.

The operational definitions, desiderata, and related work presented here suggest that (in addition to serving as a popular vehicle through which to mechanize narrative generation) automated planning can be used to model a person's narrative sensemaking at a process level; the work by Cardona-Rivera et al. (2016) is a step in that direction, which primarily targets desideratum (5). While more work is needed, we believe that exploring the interdependencies of sensemaking and generation will transformatively advance the enterprise of narrative intelligence.

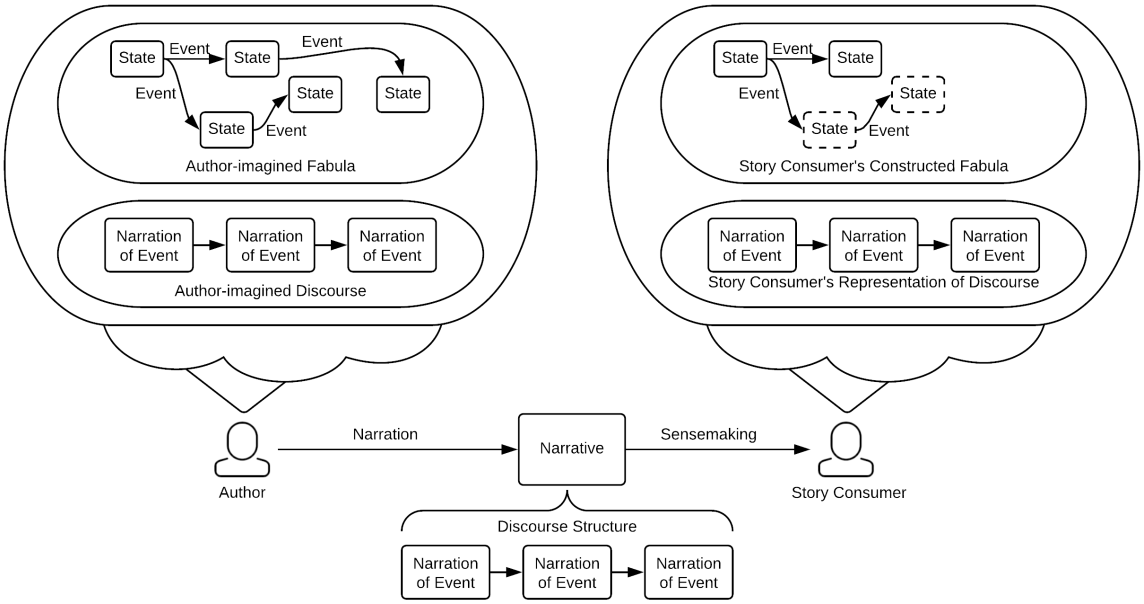


Figure 1: An illustration of the process of sensemaking in the context of a narrative artifact. The clouds represent the mental state of the person they hover over, and the cloud's contents represent the fabula. In the case of the author this fabula is defined in at least as much detail as necessary for narration, whereas in the case of the story consumer the fabula is constructed opportunistically on the basis of what is consumed; dotted squares in this cloud represent story information that is inferred. The arrows between the narrated events in the narrative represent an ordering within the discourse structure; the event at the arrow's source precedes the event at the arrow's sink.

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