

# Desiderata for a Computational Model of Human Online Narrative Sensemaking

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# Introduction

- Storytelling is increasingly relied upon in everyday life. Increased interest in modeling narrative and storytelling
- Work on Computation Models of Narrative (CMN) has expanded in two directions
  - Computational narrative generation
  - Computational narrative sensemaking (understanding)
  - The two are distinct but fundamentally related
- This paper focuses on developing a “desiderata” (set of desirable properties) for a computational model of human sensemaking
  - Grounded in hypothesized human sensemaking processes
  - Online process



# What Is Narrative

- Before defining computational models for narrative, need to define ontological models for narrative
- Paper uses the **structuralist tradition (1975)**
- Distinguishes three elements of a narrative
  - Fabula (story / plot) – a conceptualization of the underlying world in the narrative, which includes locations, characters, actions, and happenings
  - Discourse (syuzhet) – a temporally organized subset of fabula events. A narrator has chosen these events to achieve some communication goal
  - Narration (medium) – how is the story presented, such as video or oral



# The Cooperative Principal

- A narrative can be viewed as a (usually) one-way dialogue between author and consumer
- Grice (1957) analyzed the unwritten rules of dialogue and distilled four maxims
  - Quantity – Contribution is not too much or too little
  - Quality – Contribution is genuine
  - Relation – Contribution is contextually relevant
  - Manner – Contribution is clear and unobfuscated
- These principles guide a lot of story structure and tropes. For example, the literary device Chekhov's Gun is predicated upon the Maxim of Relation.
  - An object introduced early in fabula must be relevant later in the discourse



# What is Sensemaking

- Concerns how someone understands a narrative
- Uses the **reader-response tradition** (Holland 1975)
  - People give meaning to a narrative by mentally enacting it with their own experiences
  - Also posits that people impose a narrative structure on the environment to better understanding of the world
  - Agnostic to narrative goal
- However, the paper is interested in narratives with goal of communication, which is not captured fully by reader-response. Middle ground is **constructivist tradition** (Holland 1975)
  - Models the phenomenon of reader-response using the structures of structuralism
- Thus, sensemaking is the process by which a story consumer constructs mental models that represent a subset of fabula, when perceiving a narrated artifact created for a goal



# Perspectives on Sensemaking

- The processes in which humans construct mental models for sensemaking is a subject of debate. Two main groups: *representational* and *reasoning*
- These two groups of perspectives on sensemaking should together constitute guidelines for a computational model of sensemaking
- Any sufficiently good model should be able to represent events and reason



# Representational Perspectives

- Assumes that fabula elements are represented by discrete propositional mental models.
- **Event-Indexing Model** – As people consume a narrative, they mentally chunk together events into an event structure. Each event consists of
  1. Time frame
  2. Space frame
  3. Causal relation to other events (enablement, motivation, psychological, physical)
  4. Intentional relation to other events
  5. Set of characters and objects involved
- There must exist some mechanism to encode events. There are conjectured to be three types of encoding used by consumers: fabula, discourse, and medium
  - Distinguishes between representation of narrative (medium) and representation of situations described in narrative (discourse)



# Reasoning Perspectives - Recallability

- Given a cue event, want to recall a target event. Ease depends on relationship
- With the aforementioned event-index model, relationship is the order of consumption. Not very natural
- With the **event-horizon model**, relationship between events is based on content. Motivated by the **fan effect**
  - Fan effect – Assume that memory stores information in a graph. To recall a target event, start from cue event and spread to related events via relationship links. Essentially a BFS. Memory can saturate quickly
  - Competitive memory retrieval – When there is a lot of overlap between cue event and previously experienced events in the narrative. Mundane events blend together and are hard to distinguish.
  - Non-competitive memory retrieval – Little overlap between cue event and previously experienced events. Unique events are more memorable.





# Reasoning Perspectives – Situation Model

- **Situation Model General Processing Framework** - Attempts to model how humans reason about situations.
- Defines long term working memory (LTWM) and short term working memory (STWM). The STWM efficiently stores info in LTWM for future processing. LTWM allows access to previously constructed mental representations
- Framework composed of three levels.
  - Level 1 is called Current Situation Model. Uses STWM. The event that is being consumed right now.
  - Level 2 is called Integrated Situation Model. Uses LTWM. This is a global model that connects events that were read in by the Current Situation Model
  - Level 3 is Complete Situation Model. This is the final result of Level 2 after entire story is consumed



# Reasoning Perspectives - Construction of Mental Models

- QUEST model (Graesser and Franklin, 1990) – Events are consumed and placed into a directed graph called QUEST knowledge structure. Designed to be **queryable**. Returns specific answers to queries
- Problem Solving process (Gerrig and Bernardo, 1994) – Narrative consumers engage in problem-solving to **solve puzzles, challenges, or dilemmas** faced by fabula characters
- Inference making (Herman 2013) – A consumer infers unseen portions of the narrative. **Making inferences is key** to comprehension



# Reasoning Perspectives - Process of Inference

- A stance is an intellectual strategy that creates mental models of narrative
- Consumers take **stances** when understanding a narrative
  - Physical stance – explain an entity’s behavior with its physical properties (**mass, velocity, etc**) to predict a future state
  - Design stance – use an entity’s design (**appearance**) to predict future state
  - Intentional stance – use an entity’s **intentions, beliefs, or desires** to predict future state
- Adopting a stance is flexible. Evidence that humans operate in the intentional stance by default



# Reasoning Perspectives - Inference for Sensemaking

- Inference is key to understanding of narrative
- At least two types of inference
- Bridging inference – consumer infers plot that **must have occurred** between two utterances of the discourse
- Elaborative inference – consumer infers plot that will **happen immediately next** after an utterance. Happens less than bridging, depends on scripts

- (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.

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

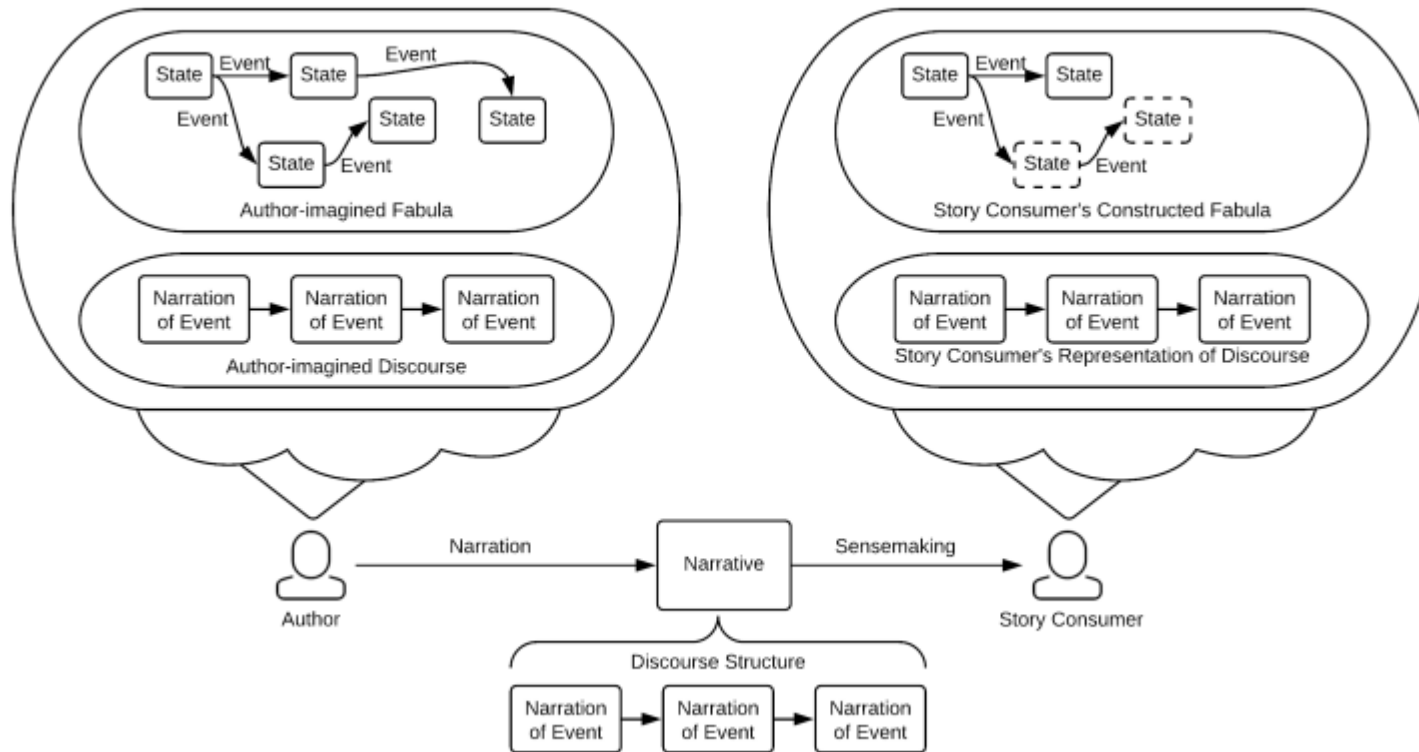


# Desirable Properties To Be Fulfilled by CMN

- Supports discrete representation of events
- Supports methods of encoding those events into discourse and situation model
- Supports story consumer's creation and management of event structure
- Supports inferences and computation over event structures, such as using event-horizon model to query
- Supports process of readers acting as solvers of problems posed by the plot
- Supports answering of 5W1H questions



# Computational Model



- Author designs fabula and discourse
- Discourse is narrated in some medium to create artifact
- Consumer uses sensemaking abilities to mentally construct fabula

# Sensemaking and Generation

- As mentioned previously, narrative sensemaking and narrative generation are distinct but related
- If generation is completely isolated from sensemaking, then there is risk of generating *ineffectual narratives* that are incoherent.
- Can leverage precise computation models of sensemaking as targets for narrative generation systems



# Conclusion

- Gave precise definitions of narrative (structuralist) and sensemaking (constructivist)
- Talked about representation and reasoning perspectives of sensemaking
  - Event-indexing model and event-horizon model
- Consumers make inferences by taking stances. Inference is key to understanding
- Distilled these perspectives into desiderata that any good computational model of sensemaking should satisfy

