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Cogmic Space for Narrative-Based World Representation.

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ABSTRACT

In this study, a story refers to an agent's internal representation involving a narrative structure, which is assumed to be a common form of organizing past, present, future, and fictional events and situations. We propose the conceptual framework of a Cogmic Space for a *comic strip-like representation of a world*. In the proposed framework, a story is positioned as a mid-level representation, in which the conceptual and sensory/bodily dimensions of a world are unified. Furthermore, this framework is associated with the generative aspect of representations. A proof-of-concept implementation is also presented to provide a concrete account of the proposed framework.

1. OBJECTIVE

This study addresses the issue of representing a world in an artificial cognitive system.

Our basic concept is that a world is represented as a collection of *stories* [1, 2]. (This concept is rooted in [e.g., 3, 4].)

A story is assumed to have a form that integrates concrete events, objects, and situations, comprising various types of information, including both conceptual and perceptual dimensions.

We propose a representational framework for a story, referred to as a *Cogmic Space*, that is designed via an analogy with narrative comics.

2. BACKGROUND & PROBLEMS

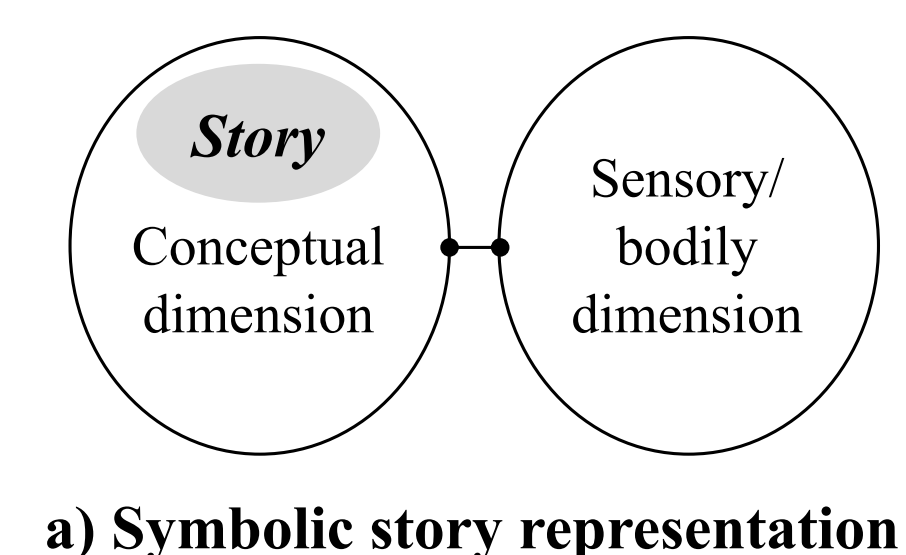
In the field of AI, stories have generally been based on symbolic representations. For example, a simple event or action can be represented as:

[Eat (agent Lisa) (object Apple)]

However, it has low representational power.

(1) Gap between symbolic representation and sensory/bodily space

In a symbolic representation, the conceptual dimension of a world is reflected in a story; however, the sensory/bodily dimension is cut off (Fig. 1a).



A Cogmic Space tends to be a mid-level representation, involving both the conceptual and sensory/bodily dimensions (Fig. 1b). (This claim is inspired by [e.g., 5])

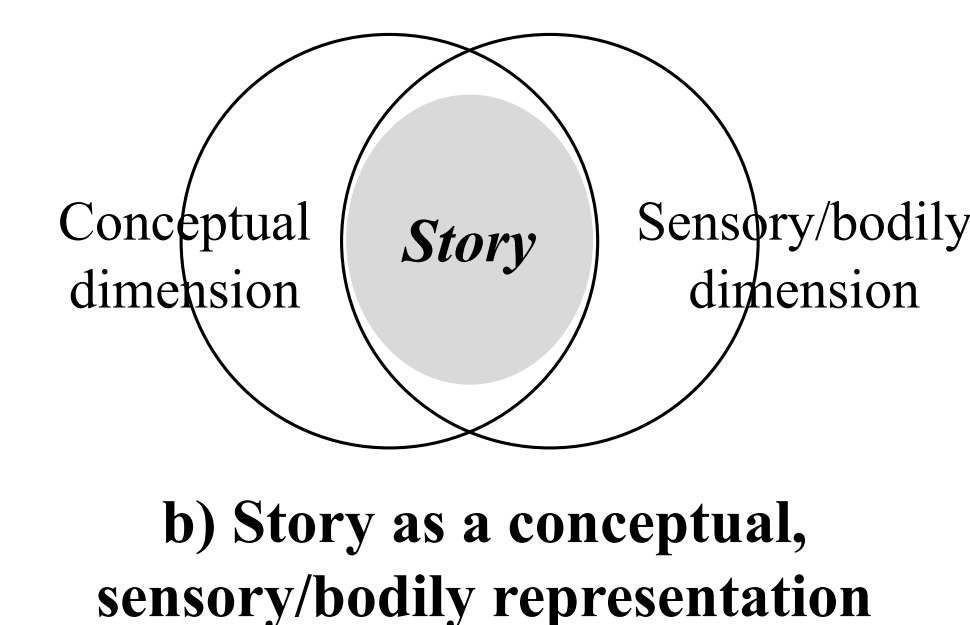


Fig. 1

(2) Division between states and events

State-based world representations are used in most AI studies. States are positioned as the fundamental dimensions of a world, and events/actions are regarded as changes in states (Fig. 2a).

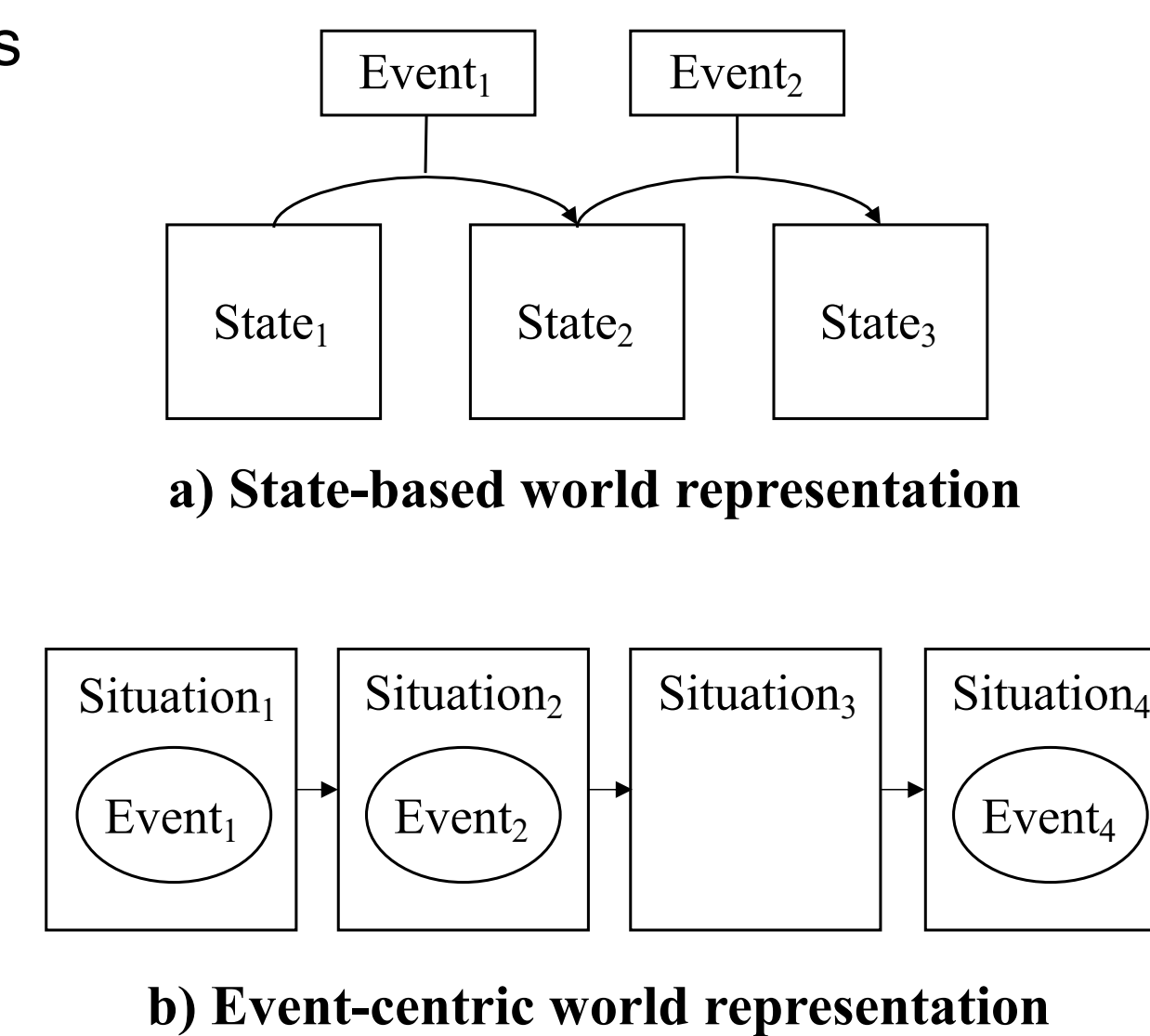


Fig. 2

(3) Stories should be generative

Stories as world representation should be generative. The remembrance of a story (memory) is also a generative process in which the story is reorganized at that moment.

This issue is related to conscious- and unconscious-level processes of a cognitive system. (Relevant theories include [6, 7])

3. BASIC CONCEPTS

The basic concepts of a Cogmic Space are simply derived from comic characteristics:

- The basic representational unit of a story is a panel (a two-dimensional spatial frame).
- A panel can contain various types of information: characters, bodies, objects, actions or motions, words, thoughts, sounds, feelings, effects, background, etc.
- A panel forms a unified representation of an event(s) and a situation.
- A story is composed of a sequence of panels. A panel's meaning depends on its context.
- The conscious-level generative process of a story is similar to reading a story, and conceptualized as inner narrating.

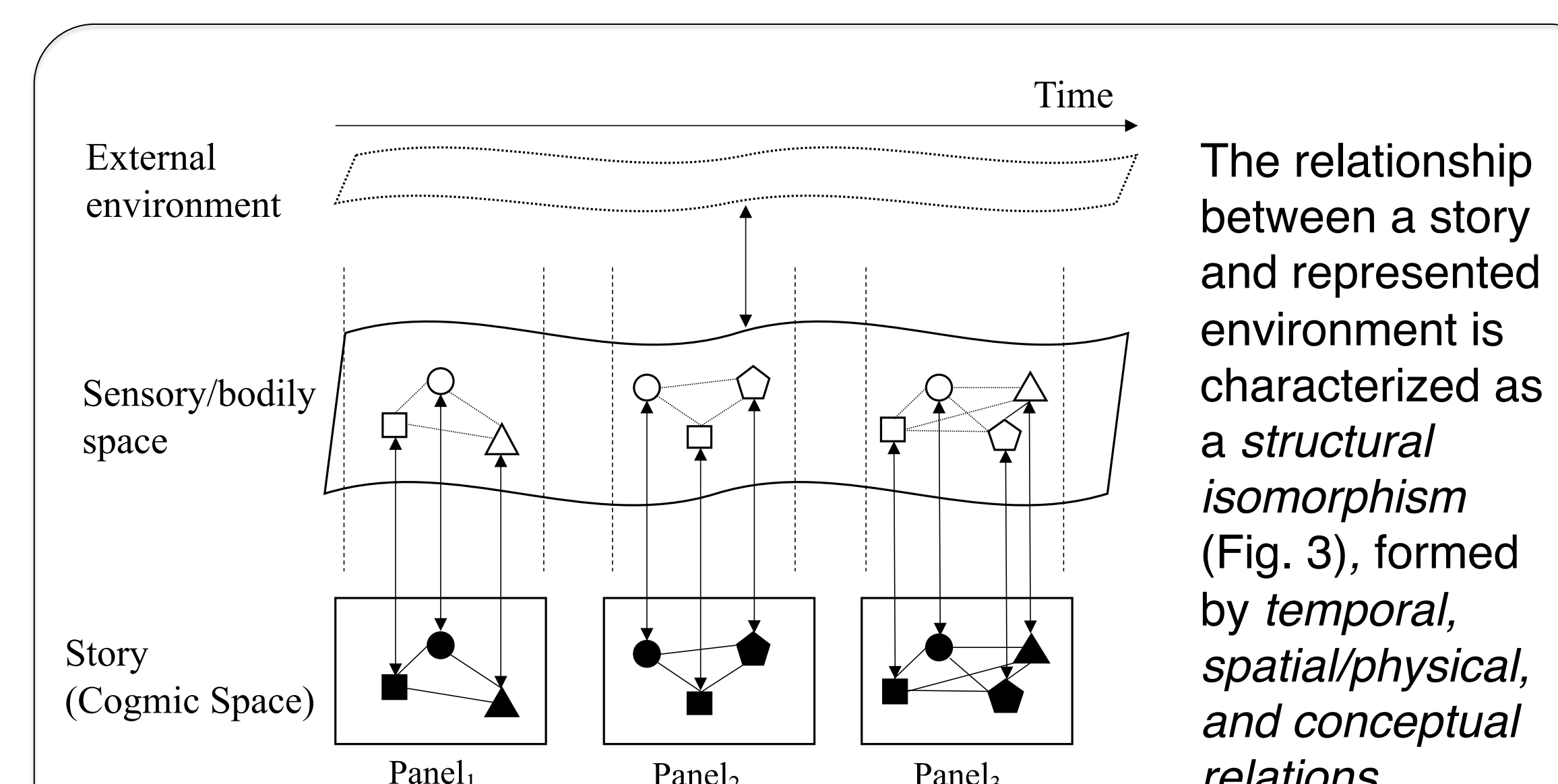


Fig. 3

4. SYSTEMATIC FORMULATION

Cognitive system structure (Fig. 4)

Story (Cogmic Space): An unconscious level world representation. (Relatively incomplete/fragmentary.)

Inner discourse (Cogmic Space): A conscious level world representation. (Relatively integrative/well-organized.)

Inner narrating: The conscious-level generative process of producing an inner discourse based on a story.

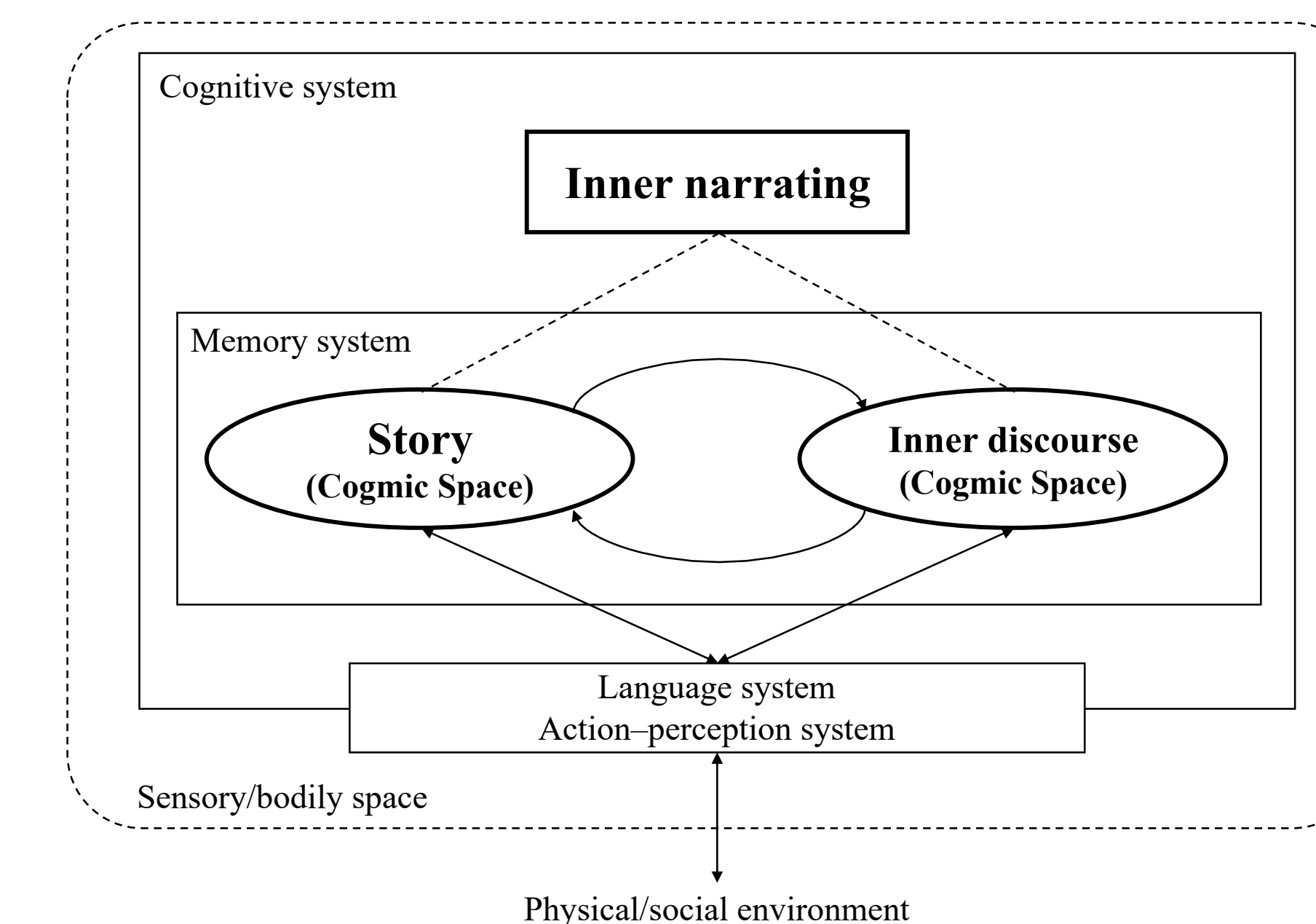


Fig. 4: Cognitive-system structure (conceptual design)

A **story** consists of a sequence of panels:

- Panel**: <Objects, Motions, Background> (Fig. 5)
 - Object**: A perceptual or conceptual element placed at a certain position in a panel as a pictorial or linguistic sign.
 - Motion**: A physical, mental, or social action in which objects are involved.
 - Background**: Conceptual information of the place and time.
- An **inner discourse** further contains:
- Continuity** and **change** of objects/motions across panels.
 - Relationship** between motions/objects.

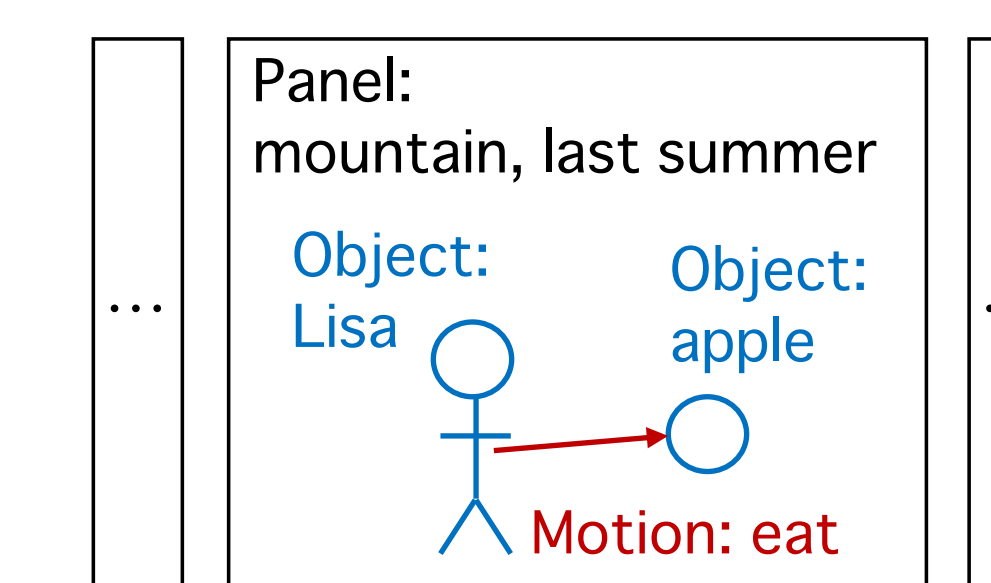


Fig. 5: Example image of a panel

5. PROOF-OF-CONCEPT IMPLEMENTATION

A part of the above formulation is implemented in a proof-of-concept fashion.

This implementation includes a **story** representation and the conscious-level generative process in which **inner discourses** are generated via **inner narrating**. This process corresponds to the mental activity during the recollection of a given story.

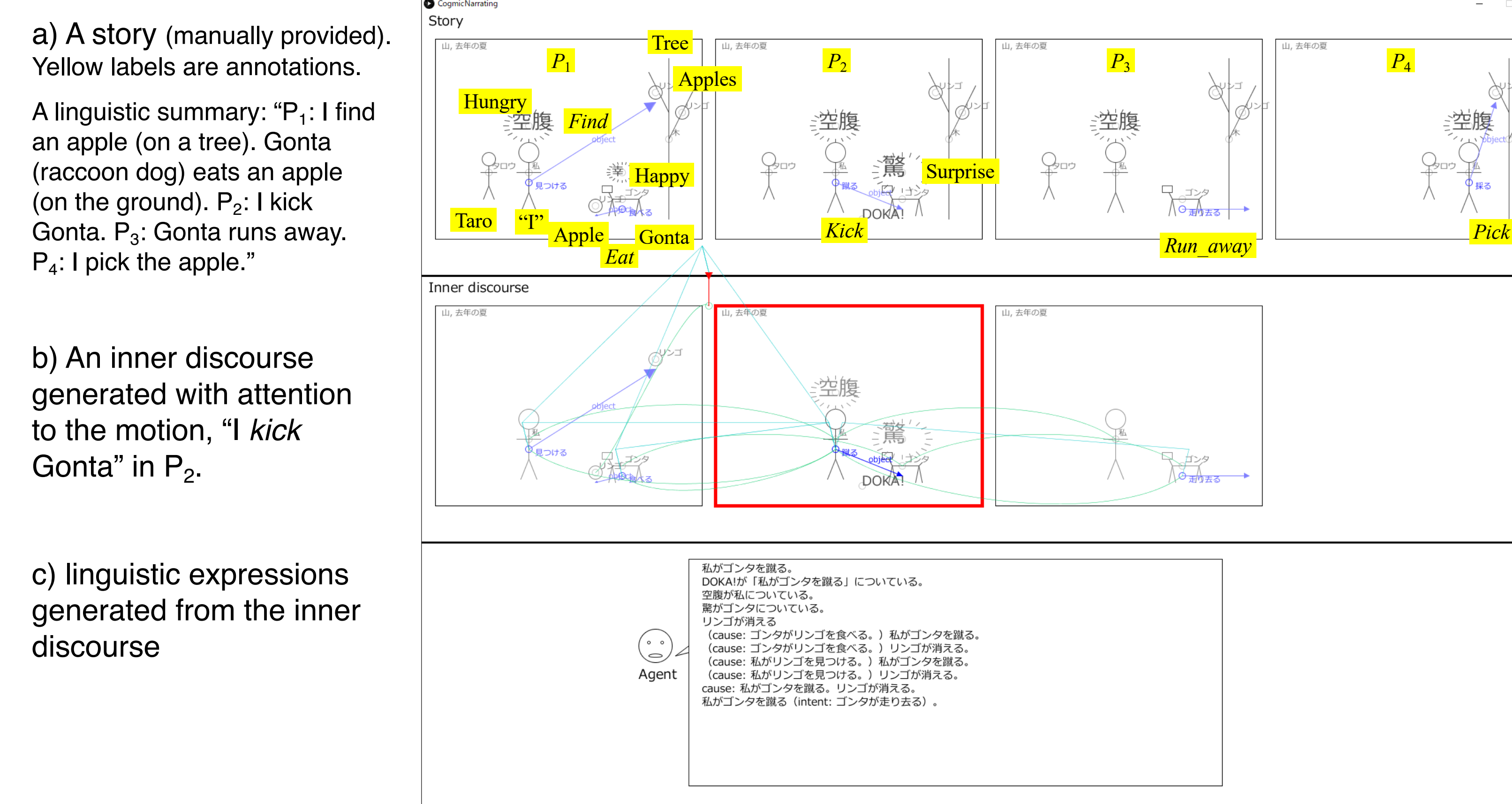


Fig. 6: Example window capture in which internal representations are visualized.

6. FUTURE ISSUES

The framework of a Cogmic Space and its generative process will be further refined.

- The present framework provides only a broad account on the sensory/bodily dimension of a story. The relationship between a Cogmic Space and perceptual process should be further studied.
- Assuming that forces of story generation is formed through experiences, the qualitative richness of experiential representations is important. How Cogmic Space can be utilized to generative story cognition will be further considered, in terms of memory organization, analogy, and conceptual blending.

7. CONCLUSION

This work presented a computational theory for world representation in an artificial cognitive system or architecture.

The key properties of a Cogmic Space:

- A Cogmic Space represents a (piece of) world as a story in a form similar to narrative comics.
- A story is a mid-level representation in which the conceptual and sensory/bodily dimensions are unified.
- The events and situations are unified into a sequence of panels.
- A story and the represented environment are connected by an isomorphic relationship.
- The conscious-level generative process of a representation is characterized via an analogy with the reading.

ACKNOWLEDGMENTS & REFERENCES

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