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Dissemination Corner

The Logic of Conceivability: Applying LoC-Style Models to Imagination

The Logic of Conceivability (LoC) project studies the logic of propositional intentional states in many different ways. One example that we often mention is *imagination*: imagining that Trump will invade Europe, imagining transparent iron, imagining being at a tea-party, imagining that you go on holiday, etc. Last time, Franz spelled out the general framework that the LoC is developing to account for such states: the theory of topic-sensitive modals. Here, I want to discuss one of the applications of such a model: developing a formal theory of *pretense-imagination*.

Pretense is the fascinating cognitive phenomenon of make-believe. Consider the following example of a pretense tea-party:

> The child is encouraged to 'fill' two toy cups with 'juice' or 'tea' or whatever the child designated the pretend contents of the bottle to be. The experimenter then says, 'Watch this!', picks up one of the cups, turns it upside down, shakes it for a second, then replaces it alongside the other cup. The child is then asked to point at the 'full cup' and at the 'empty cup' (both cups are, of course, really empty throughout). (Leslie, 1994, p. 223)

Children, from a very young age on, consistently point to the cup *that has been turned upside down* when asked to point at the 'empty cup'. This indicates that children are able to engage with pretense even if it goes against what they believe the world to actually be like. One of the main questions that then arises is that of *how* we develop such a pretend scenario that seems so rational, but is often in contradiction with our explicit beliefs: the children explicitly believe that both cups are empty, yet they behave in pretense in a rational way *as if* one of the cups is full. They imagine this non-actual scenario in a *reality-oriented* way. Which logical rules, if any, govern the development of such a pretense scenario? We can gain some insights into this issue by applying an LoC-style model to it.

Pretense-imagination – i.e., the imagination that we engage with in pretense – is used in many different settings, from make-believe games of children to future-planning and *what-if* conditionals (see for example, Byrne's fantastic work on *Rational Imagination*).

We can develop an LoC-style formal model of pretense-imagination from which we can read off sequences of individual imaginative stages, denoted by (*imstage*), that form imaginative episodes, *imag*. As the pretense-imagination follows 'belief-like' inference patterns and develops in stages, we use a simplified version of *branching-time belief revision models* (cf. Bonnano 2007). Using these branching-time belief revision model, we can model the development of (hypothetical) belief revision over time. Hypothetically revising your beliefs is exactly what happens in pretense as make-believe: you consider what you *would* do and believe in a particular situation (e.g., when at a tea-party). By making some formal assumptions about the models that we consider, we can create a special set of branching-time belief revision models. In these models we can *track* which propositions (up to logical equivalence) an agent revised their beliefs with in order to get to the next belief state. Given a particular development of the pretense, we suggest that the content of the pretense-imagination are those propositions with which an agent updated their hypothetical belief.

The resulting models look like the one in Figure 1.

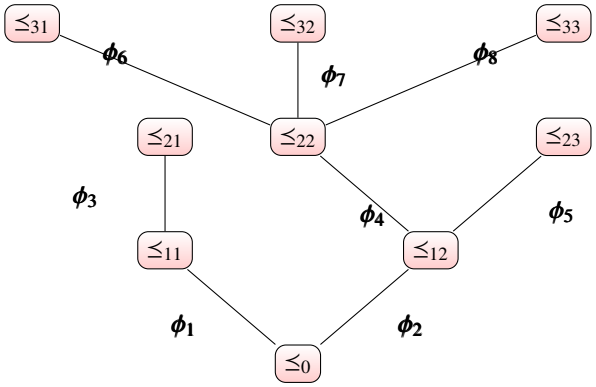

Figure 1: Branching-time belief revision model

At this point, our model of imagination still has two problems.

1. Imagination fails to distinguish between logically or necessarily equivalent propositions, imagining one automatically leads to imagining the other. In other words, we have something like the problem of logical omniscience for pretense-imagination. This results in highly unrealistic predictions for what agents imagine. Consider again the tea-party example. According to the proposed semantics, if the agent imagines at a stage that one of the cups is full, they also imagine that one of the cups is full *and* $2 + 2 = 4$. However, intuitively, we can imagine or believe the former without imagining or believing the latter and *vice versa*.

2. Secondly, imagination fails to be sensitive to the context in which the pretense is set. (This is a problem for imagination that is not often acknowledged in the literature.) In particular, it turns out that pretense-imagination is sensitive to, what we call, an *overall topic*. This takes into consideration some of the contextually relative overall aims, goals, and topics of an imaginative episode. To see what we mean by 'overall topic' and how this affects the imagination, consider the following two situations:

   Context A:
   Your are flying to Australia the day after tomorrow to take a well-deserved holiday. That evening, when watching the news, you find out that there is a tornado in Indonesia and that nothing else is known at this point. You wonder whether this influences your flight.

   Context B:
   You have a friend living in Singapore, who

> lives right by the coast. That evening, when watching the news, you find out that there is a tornado in Indonesia and that nothing else is known at this point. You wonder whether this might affect your friend.

In order to help you evaluate the effects of the tornado in each case, you engage in an imaginative exercise. In particular, in both cases, you use the following explicit input

(1) There is a tornado in Indonesia,

and start the imaginative process to determine the effects thereof. As **Context A** involves holiday planning and **Context B** is concerned with your friend living close to a tornado zone in Indonesia, the imaginings resulting from (1) could be different in **Context A** and **Context B**. For example, imagining 'Booking a flight through the US rather than Indonesia is safer' seems to be *off-topic* in **Context B**, whereas it is *on-topic* in **Context A**.

Dealing with these issues is where the LoC-style comes really into its own. What we do is add a *topicality* component. To do so, roughly speaking, we endow branching-time belief revision models with (an enriched version of) *topic models*. This allows us to deal with both the idealisations as well as the context-sensitivity in relation to the overall topic.

According to the new topic-sensitive semantics, the agent imagines φ if they have revised their belief state with φ at some earlier stage in the history and *the topic of φ is included in the intersection of the overall topic of the imaginative episode and the topic of the agent's belief state*. The addition of the overall topic allows us to deal with the context sensitivity of pretense-imagination. So, an agent no longer imagines that the cup is full and $2 + 2 = 4$, because the latter conjunct is not included in the overall topic. Similarly for the context-sensitive case described above. The overall topic of **Context A** 'allows' for imagining that you book a flight through the US rather than Indonesia (as this is included in the overall topic), whereas **Context B** doesn't. Logics of imagination that do not acknowledge the need for such an overall topic fail to be able to distinguish between these two cases.

All this together results in a formal model of pretense-imagination. By using tools from dynamic epistemic logic, belief revision theory, as well as more recently introduced, LoC-style topic models, we can deal with issues concerning idealisations, irrelevant background beliefs, and the context-sensitivity of pretense. LoC-style models prove to very nicely model phenomena such as pretense-imagination.

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