



## COGNITIVE DYNAMICS: RED QUEEN SEMANTICS VERSUS THE STORY OF O

**Abstract:** *It appears that indexicals must have fine-grained senses for us to explain things involving human action and emotions, and we typically identify these different senses with different modes of expression. On the other hand, we also express the very same thought in very different ways. The first problem is the problem of cognitive significance. The second problem is what Branquinho (1999) has called the problem of cognitive dynamics. The question is how we can solve both of those problems at the same time. Vojislav Božičković (2021) offers one solution in which the cognitive dynamics runs through the objects of the attitudes. I discuss this solution and offer an alternative in which the theory of cognitive dynamics has no use for the objects of the attitudes to unify expressions of attitudes. When we say or believe “the same thing” using different modes of expressions, it is by virtue of our deploying a dynamic theory of attitude expression. Like Lewis Carroll’s Red Queen, we must run to stay in place.*

**Keywords:** *Indexicals, cognitive significance, cognitive dynamics, tracking, red queen semantics, attitudes.*

The topic of indexicals has exercised analytic philosophers for over a century, in part because Frege framed the problems so cleanly. The central issue is this: On the one hand it appears that indexicals must have fine-grained senses for us to explain things involving human action and emotions, and we typically identify these different senses with different modes of expression. On the other hand, we also express the very same thought in very different ways. The first problem is the problem of *cognitive significance*. The second problem is what Branquinho (1999) has called the problem of *cognitive dynamics*. The question is how we can solve both of those problems at the same time.

To see why solving both problems at once is difficult, let’s start by reviewing the problem of cognitive significance. John Perry (1979) has catalogued a number of examples where a theory of cognitive significance is called for, including cases of personal identity, spatial separation, and temporal separation. To illustrate the personal identity case, Perry draws on

an incident described by Ernst Mach, in which Mach once boarded a bus and saw a shabby-looking man, which prompted him to ask himself, “who is that shabby pedagogue,” not realizing he was looking in a mirror. As Perry correctly notes, there is a thought that Mach expresses with an utterance ‘I am a shabby pedagogue’ which he does not express with an utterance of ‘he is a shabby pedagogue.’

The temporal case works in the same way. Developing an example from A.N. Prior (1959), knowing that I have an appointment with the dentist for a root canal today is quite different from knowing that I have an appointment with the dentist on a particular date – say June 1 – if I have lost track of the date and don’t realize that today is June 1. Knowing that the appointment is *today* explains my anxiety as well as why I get up and go to the dentist when I do. Similarly, as Prior pointed out, it is only by knowing the root canal is in *your* past that you can feel relief about it. It is not enough to know that the root canal is earlier than a particular time.

The spatial case also works in the same way. Knowing that a ticking timebomb is in such and such spatial coordinates may not get me up and running in the same way as the knowledge I express when I utter ‘the bomb is here.’

In all these cases, there is pull to introduce fine-grained sense content to explain my difference in attitude in these cases. We can say that we are providing the fine-grained sense content to account for the cognitive significance of our thoughts.

On the other hand, there are cases where the fine-grained indexical content we introduce to account for cognitive significance leads to puzzles. Consider the case, discussed by Frege, where there is a thought that I express with the words ‘Today is a fine day’ and then express that very same thought the following day with the words ‘Yesterday was a fine day’. We want to say that we are expressing the same thought in these two cases, but are we not deploying different senses by using the words ‘today’ and ‘yesterday’? How can we be expressing the same thought? This, again, is the problem of cognitive dynamics.

Engaged individually, the problems of cognitive significance and the problem of cognitive dynamics are not so hard. The real difficulty comes when we want to solve *both* problems, because the apparent solutions seem to be at cross-purposes. The problem of cognitive significance leads us to posit finer-grained sense content to account for the explanation of our actions and emotions. Meanwhile the problem of cognitive dynamics calls us to show how two episodes of thought can have the same fine-grained sense content even though the thoughts are expressed in different ways at different times and places. The second problem calls us to collapse sense contents, or more accurately, it calls us to explain how the very same sense content can be expressed in different ways.

One natural solution to the puzzle is to surrender on either the problem of cognitive significance or the problem of cognitive dynamics. Let's lump these solutions together under the umbrella descriptor of *the surrender strategy*. What is the surrender strategy? One version of the surrender strategy is to say that semantics shouldn't be interested in the business of cognitive significance. In the words of Wettstein (1986) when semantics gets into the business of cognitive significance, it is "resting on a mistake." Another surrender strategy (associated with Heck, 2002) is to give up on the cognitive dynamics part. You actually aren't thinking the same thought in these cases (e.g., when on day one you have a thought which you express by saying 'today is a fine day' and on day two you have a thought which you express with 'yesterday was a fine day'). Maybe there are independent reasons to think that semantics has rested on a mistake, and maybe there are independent reasons to believe that we aren't thinking the same thought from different perspectival positions. My portfolio here is limited. What I aim to argue is that cognitive significance and cognitive dynamics are not in conflict. You can have your cake and eat it too. A compatibilist solution is possible, but we have to get the cognitive dynamics part right.

I'm not the only one who thinks this. In a recent book, Vojislav Božičković (2021) also develops a compatibilist strategy. He and I are fundamentally on the same team here – we both reject the surrender strategy – however, I do not think his account of cognitive dynamics works. His answer comes to this: To give an account of cognitive dynamics, we need to posit some particular thing (I will call it a *cognitive object*), distinct from the thought itself, that can anchor our expression of the same thought at different times and places. I, on the other hand, want to say there can be no such thing, but that we nevertheless do express the same thought in different ways.

To be clear, my target is not really Božičković's proposal so much as a hypothetical class of solutions that attempt to reify something that is going to serve as the hook or binder that keeps the expressions of sense content linked together so that we can say they express the same thing. My solution, by way of alternative, is going to be that while no individual objects can link together expressions of sense content, a theory of cognitive dynamics can explain and predict when these expressions are linked together.

In a bit I'm going to walk through the Božičković proposal in some detail in order to argue that his appeal to (cognitive) objects isn't going to work, and after that I am going to argue that these same objections are going to infect any like-minded theory. Anyone attempting to do what Božičković is attempting to do will run into the same problems.

Before we get into the Božičković strategy, however, I should probably say a word or two about my own strategy here as developed in my (2019) book *Interperspectival Content*. As the title of the book suggests, we are interested in expressing the same thing across diverse perspectival positions. The easy

way to do this, of course, is to dispense with sense content and just stick with objectual or referential or official content or whatever you choose to call it. That is, of course, one of the surrender strategies. Unless supplemented somehow, it surrenders sense content and thus our ability to explain actions and emotions and, as I argued in my book, many other things including ethical decisions, scientific practice, and even information and computation. (I will touch on the latter two cases in a bit.)

So how does interspectival content work? As I said, on my view there are no individual objects that can be the magic content that glues together diverse ways of expressing the same thing. That is, if yesterday I utter ‘today is a fine day’ and today I utter ‘yesterday was a fine day’ I am saying the same thing, but there is no separate object that is unifying those two expressions. What unifies the expressions so that they express the same thing is a great big theory about how we glue these and other expressions together. Let’s call this great big theory *Theta*.

What is *Theta* and how does it work? Let’s illustrate by first talking about belief attributions. Many years ago (1993), Richard Larson and I published a paper called “Interpreted Logical Forms,” in which we covered related ground. On the one hand we want fine grained sense contents to discriminate beliefs (for example the belief expressed by ‘Harvard is a fine school’ from the belief expressed by ‘[Hahvahd] is a fine school’). Larson and I argued that the objects of belief would have to incorporate syntactic information broadly understood to include phonological information as well. But then we noted that there are also cases where we use different expressions to say the very same thing. This is because we want to be able to say that the same belief can be expressed in different ways and indeed in different languages.

I hope it is clear that this is basically the same problem as the problem we encounter with the tension between giving an account of cognitive significance and an account of cognitive dynamics. And it is not unheard of to despair of a possible solution here. In fact, in my very first meeting with Noam Chomsky (in 1983), he argued that any account of the attitudes would founder on exactly this point, and he referenced a paper by Israel Scheffler (1955) which I later learned Chomsky had been citing since he was a post doc, when Scheffler’s paper was still in draft form. Admittedly, it is a hard problem and some of the smartest people in the world think there is no solution to the problem.

These very smart people are not wrong if we take their targets to be the idea that there is some simple solution to the dueling demands of cognitive significance and cognitive dynamics. In a bit, I’ll explain why. But Larson and I weren’t offering up some simple, easy story involving fixed objects of belief. We were offering up a theory of how we dynamically coordinate expressions of meaning without the help of such fixed objects.

The core idea of our theory was that when we engage in belief attribution, we are not denoting a fixed structure that is represented in the mind/brain. We are rather providing information to our communicative partners that will help them construct a theory of the cognitive makeup of the person we are attributing the belief to. This involves lots of background assumptions that we have with our communicative partners about our shared goals in belief attribution and quite a bit of common-sense reasoning, but critically it also involves a strategy we have for constructing mental models of the person we are reporting on and how we tacitly negotiate the expressions we will use to speak of the different components of those models.

What does that mean? Sometimes we are talking about someone that doesn't know the Morning Star is the Evening Star, and we may choose to assign the expressions 'Morning Star' and 'Evening Star' different roles when we are in the business of attributing beliefs to such a person. Why would we do this? Well presumably we would do this because we are interested in the actions and emotions of the person we are reporting on. If we say to them "the Evening Star is a lovely hue of blue these days," we might be interested in whether the person will take out a telescope and look now (this morning) or wait until evening. We are in the business of theory construction, after all, and what we want our theory to do is help our communicative partners better understand the actions and emotions of the person to whom we attribute beliefs.

We don't need to go into a lot of detail for current purposes, but one element of the theory requires comment. It is at this point in the belief attribution process that the issue of the dynamic lexicon enters the story. This is the story that I developed in Ludlow (2014) and the keynote idea of that is that we often engage with our communicative partners by constructing "microlanguages" in which we introduce new terms and modulate word meanings as needed for current conversational purposes. Word meanings thus shift all the time, and much of what we are engaged with in discourse – even in our use of declarative sentences – has more to do with the task of modulating word meanings than it does with the task of directly describing what is going on in the world.

Now, given that our language is very much in flux, even on a conversation-internal basis, it follows that the way we express certain cognitive states will likewise shift on a conversation-internal basis, and since we are in the business of explaining what someone might feel or do, we are in the business of negotiating the use of fine-grained expressions to help accomplish this. So, the expressions we use must of necessity be in flux. As Gareth Evans (1996) remarked regarding indexicals, "we must run to stay still." Here, Evans is referencing the Red Queen from Lewis Carroll's *Through the Looking Glass* – a character who had to keep running just to stay in place. It is an apt metaphor for my project, which I call *Red Queen Semantics*. The idea is that

semantic theory can't deliver up static objects as meanings but must provide a theory of how we use diverse expressions at diverse times and places to say the same thing.

This means that things are complicated. Sometimes we use different expressions to express different things. Sometimes we use the same expression to express different things. Sometimes we use the same expression to express the same thing. And sometimes we use different expressions to express the same thing. It all depends on the theory we are currently constructing, with our conversational partners, to explain the actions and emotions of the agent we are talking about (sometimes, of course, talking about ourselves).

Does this mean that we have dispensed with beliefs and thoughts and meanings? Not at all; it simply means that beliefs can't be latched onto permanently with a single use of language. It is a dynamic process. There is no one expression you can use to say the same thing in different places at different times. There is no "view from nowhere" in which you can permanently articulate belief contents or thought contents or meanings.

In Ludlow (2019) I took this basic idea about belief attribution and observed that it is basically already designed to account for our use of indexicals in explaining the actions and emotions of other agents (and ourselves, for that matter). You simply have to understand that things like essential indexicals are handy tools that we have for constructing these dynamic theories. From this perspective, essential indexicals are not weird outliers in our semantic theory. They are core cases, and indeed are completely normal and native elements to a Red Queen semantic theory.

The big point in all this, the one that needs to be reiterated, is the idea that there can be no objects that serve as perspective-neutral descriptors of the contents of indexical thoughts. Indexicals (I would prefer to call them perspectival expressions) are just components in theories that we are constructing on the fly (similar to Davidson's notion of passing theories). The theory will have to be packaged in different ways at different times and in different places and for different persons. This means that semantic theory is not the business of constructing aperspectival sets of rules for fragments of natural language, but rather is the business of understanding the mechanisms by which we are able to construct these very perspectival passing theories.<sup>1</sup>

One might wonder if it really must be so complicated. Isn't there some other way to thread this needle and account for cognitive significance and cognitive dynamics without all the talk about micro-languages and shifting theories that must be expressed in different ways at different times and different places? This leads us to Božičković (2021).

Božičković has an admittedly simpler theory for unifying the different ways we have of expressing the same thought or sense content. I want to

1 This doesn't mean we can't have fragments. It means that fragments must be continually updated, and that semantic *theory* must therefore be a theory of how we accomplish this.



spend a fair bit of time on this proposal because I believe it provides the best possible effort to give such a simpler account, and thus helps us to see what the difficulties here actually are.

Božičković wants to bind together the different ways of expressing the same thought as I do, but without my big, complicated theory Theta and the Red Queen Semantics. He has a different story of how expressions of sense are bound together. What is his binder? The idea is that we express the same thought about some object *o* from different perspectival positions just in case we unreflectively assume that *o* is held constant across these perspectival positions.

So, for example, what binds together my yesterday's thought, expressed by an utterance of 'today is a fine day' with today's thought, expressed by an utterance of 'yesterday was a fine day', is the day itself. It is the object *o* that is deployed to bind together the different expressions of sense.

It isn't quite this simple, however, because the object alone is not a sufficient condition to bind the sense expressions together. For example, I might come to suspect it is not the same object in the two thought episodes. We will get to cases like this in a bit. But first let's stay focused on *o* itself.

The first issue is the availability of the object *o* and what is required for us to have (presumably) referential thoughts about it. It seems that reference to *o* has to come on the cheap, because we are going to discover cases in which we don't have causal access to *o*. As Božičković (2022) notes, I might have thoughts about tomorrow. For example, I might have a thought which I will express as 'tomorrow will be a fine day'. Tomorrow isn't in my causal history, so how do I refer to it? Božičković opts for a more liberal story about reference from Hawthorne and Manning (2012).

So far, all this is coherent enough. We can spot him a liberal account of reference. But here is where things start to get tricky. Sometimes we have thoughts which aren't linked to any existing objects at all. Consider Peter Geach's (1967) case of Hob, Nob, and Cob, who all believe a witch has been blighting their mare. But there is no witch. So, there is no object to unify their beliefs. To make the issue particularly sharp, let's add a temporal dimension to it. Hob has a thought on day one, which he expresses by uttering 'today the witch is blighting my mare'. On day two he reflects on his earlier belief and expresses it by uttering the following: 'yesterday the witch was blighting my mare'. Presumably, we want to say that Hob had the same thought in these two episodes, but what is the object *o* linking those thoughts together? In response, Božičković offers the following:

I claimed that in order for a belief about an object (or day) to be retained, it is required that the thinker's belief has the relevant internal continuity. Similarly, there is an internal interpersonal continuity between our present interlocutors' beliefs that binds these different expressions into a single sense content (which lacks reference) that accounts for the

‘intentional identity’ that Geach (1967), Edelberg (1986) and others have been concerned with. (2022: 77)

But what provides this interpersonal continuity? What is the thing that unifies the thoughts of Hob, Nob, and Cob, and which ultimately unifies the two episodes of thought by Hob on day 1 and day 2? We can agree that the thoughts must be unified, because we have rejected the surrender strategy and both Božičković and I have maintained that an account of cognitive dynamics will unify everything. And Božičković wanted to introduce an object *o*, that could unify our beliefs in the standard cases (today is a fine day/yesterday was a fine day) but now we get into territory where there is no such object to knit the belief episodes together. It isn’t really helpful to be told that there is “an internal interpersonal continuity.” That is the thing that the account of cognitive dynamics was supposed to explain.<sup>2</sup>

All of this of course leads to the following question: If you *can* successfully link expressions of thought together without the help of object *o*, why do you need the object at all? You didn’t need it for the Hob, Nob and Cob case, so why do you need it for the today/yesterday case? Perhaps the answer is that one needs some sort of intentional object employed in these cases, or alternatively it is not *o* itself that links things together, but a representation of *o*. This is at least suggested by the passage in Božičković’s reply in which he speaks about mental files. Whether this is the strategy or not, it is certainly an option. One can say that it is not really the object *o* that glues things together, but rather the file that we keep on *o*. If there is no object *o*, you can still have the file. I don’t mean to suggest that using mental files is the only strategy here, but it does seem that there must be some representational layer doing the work of unifying things.

But notice now that this is not only an issue in cases of witches, but it is an issue in cases where the object about which we have beliefs is not only real but even quite salient. Why so? Well, as Božičković notes, the critical issue is whether there is an “internal continuity.” But this can’t come for free, even if the object *o* is there. Let’s start with the following passage from Božičković, in which he considers whether the thought I have about a bottle of wine in my refrigerator is stable, or whether it must come apart (as it would when I incorrectly suppose the bottle has been switched):

Suppose the bottle has remained the same and I unreflectively take it for granted that it is the same bottle from Monday to Tuesday. The sense that I am entertaining is thereby the same throughout. Once I have abandoned this assumption, the senses split and are no longer the same. (2022: 79)

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2 The “internal interpersonal continuity” line is also troubling for other reasons. First of all, internal to who or what? How can it be internal and interpersonal at the same time, barring some sort of Hegelian story in which Hob, Nob, and Cob share a mind to which the intentional object is internal?



The part I want to focus on here is the expression ‘take it for granted that it is the same bottle’. Just how innocent is this expression? Or to put it another way, what does he mean by ‘take it for granted’ here? Here is a possible story. Above, in the case of Hob, Nob, and Cob we envisioned that Hob kept a mental file on the supposed witch. Notice that the same sort of thing seems to be required here. I open the fridge on the second day, and I either keep the original file for the bottle or open a new file. Notice that this can’t be the product of some reflective decision. If I merely entertain the idea that it might be a new bottle, I must open a new file.

In a little bit I am going to press this inquiry further and interrogate what it means to open a new file, but notice here that fundamentally we aren’t that interested in the object *o* itself, so much as in the file (or files) we keep on *o*. This is so not merely to help us handle the Hob/Nob/Cob case, but even the simplest cases in which we wonder if a switch has taken place (wine bottles etc.). It might not be files, but it has to be some representational object distinct from the object *o*. Let’s come up with a generic name for whatever this is –  $f(o)$  – to either indicate the file on *o*, or some function that maps to a representation of *o*.

What’s wrong with this idea? Well, the general strategy is this: Introduce some object and have it serve as the glue or binder rings that hold together the different ways of expressing the same sense content. But we need to ask, what exactly are we talking about when we talk about  $f(o)$ ? The danger here is that the story of  $f(o)$  will collapse into a story that is completely vacuous. To wit, that the story of  $f(o)$  is whatever we need to keep the sense expressions unified. It is “that which binds these things together.” It is in that case the semantic equivalent of “dormitive powers.”

Before we take a deeper dive into the tricky business of mental files, I want to dwell just a bit longer on our bottle of wine, for there is a lot going on here, and any account of  $f(o)$  will have to deal with these details. Let’s say that at time  $t_1$  I put the bottle of wine in my refrigerator, uttering to myself ‘this wine is supposed to be delicious’. The next day, let’s call this time  $t_2$ , I open the fridge and look at the bottle and again utter ‘this wine is supposed to be delicious’, without wondering if it is the same bottle or if a trickster has moved it or if I have forgotten replacing the wine in the fridge. In that case, an utterance of ‘This wine is supposed to be delicious’ at  $t_1$  and my utterance of ‘This wine is supposed to be delicious’ at  $t_2$  can express the same thought, but just in case it is the same bottle. Recall that as soon as I wonder if the bottle has been switched, the sense contents must come apart. Representations (files) would be multiplied to accommodate this possible expanded ontology.

There are things to puzzle over here. For example, in Ludlow (2022) I worried that this strategy might undermine our past and future thoughts. So, for example, suppose that at  $t_1$  I put a bottle of wine in the fridge and utter ‘that wine is supposed to be delicious’. At  $t_2$  I remind myself what I said and

utter ‘Yesterday I thought that wine is supposed to be delicious.’ I can do that on Božičković’s proposal because it has never occurred to me that there has been a change in bottles. But now suppose that on Friday (let’s call it time  $t_3$ ) I learn that my roommate has been changing things in my fridge, drinking things in the evenings and replacing them, so that I come to wonder if it was indeed the same bottle. Do the senses of my earlier two thought events now come apart? I argued that they must come apart because I am no longer in a position to express both thoughts in the same way. I have doubts about the stability of the underlying referential contents. That is to say, whatever sense content I express after  $t_3$  with an utterance of ‘I thought that wine is supposed to be delicious’, it cannot be the same as both the  $t_1$  thought and the  $t_2$  thought. On Friday I can express the Monday thought, or I can express the Tuesday thought, but I cannot express both at the same time, because the sense contents have retroactively come apart.

Božičković is unimpressed by this objection:

The fact that [the sense contents] will split in the future does not affect the fact that prior to this I keep thinking of the bottle via the same sense. (To allow the future divisions of sense to affect my current state of mind is also to admit of senses a difference in which is not transparent which is at odds with the transparency thesis that I hold on to in the book.) (2022: 79–80)

But here is the problem. It is all very well to say that my thought episodes are unified at the earlier time and it is also very well to say that my thoughts must be separate at a later time. The problem comes in when we want to say that I can recall my earlier thoughts after the switched-bottle reflection has been induced in me. I believe (and I assume Božičković believes) that I can recall my  $t_1$  and  $t_2$  thoughts at a later time, but how does this work given that I no longer have the correct sense content in which to clothe those thoughts?

Here we need to speculate. Maybe, after using only one object file, call it file  $f(o)$ , at  $t_1$  and  $t_2$ , and after introducing separate files, call them files  $f_1(o)$  and  $f_2(o)$ , at time  $t_4$  I can still deploy that unified file  $f(o)$  and it is this file that I use for my memorial access to the earlier thoughts.

One issue here is that the project we are embarked on is not exactly representationally austere. We not only have to split files as needed, but we also have to keep the original files around in case we ever need to recall our pre-fission thoughts. This would be true in the opposite direction as well. If files are fused you have to keep around the pre-fusion files in case you ever decide to recall an earlier pre-fusion thought (for example, before you knew *The Morning Star* was *The Evening Star*).

A further issue involves the question of how it is that I can access a unified sense content at  $t_4$ , when it was supposed to be automatic for these sense contents to come apart the second I begin to wonder whether there has been an object switch.

But the real issue is the issue I raised earlier, and which has now returned with a vengeance. We were earlier worried about whether we have any independent handle on these files or whatever the representations  $f(o)$  are. Now, whatever they are, they seem to be positively magical. Did we actually add something contentful when we called the secret ingredient for cognitive dynamics “ $f(o)$ ” as opposed to simply “the sense content”? I don’t think so. It seems that we only know to introduce files when we think we need to introduce a new sense content to distinguish our thoughts and we know to unify the files again when we need a single sense content.

You might think that shifting to talk of files or representations gets us further because it embeds the talk in a field of empirical enquiry – cognitive science – and we can understand files to be data structures of some form within this field, but this is in fact just a way of repackaging the same problem. There is no independent way to ground the existence of the requisite data structures/files. There is also no aperspectival way to identify the relevant data structures/files. Let’s take the latter issue first.

Let’s assume for the moment that the idea of data structures/files is unproblematic and that we can ground data structures with no problem (we will question this assumption in a bit). We will say that data structures are semi-stable syntactic states of a computational system that encode the information we have about objects in the world. Returning to our example of the bottle of wine, the proposal on the table is that we have a single data structure for the wine-related thoughts at times  $t_1$  and  $t_2$  – this was  $f(o)$ . Then there are the  $f_1(o)$  and  $f_2(o)$ , which are the files that get deployed after  $t_3$ . The issue is that it isn’t enough for me to *have* these files; crucially I have to deploy the correct file. Let’s say that at  $t_4$  I recall my  $t_1$  thought. So I must deploy the file  $f(o)$ . But what makes it so that I am applying that file as opposed to one of the others? It seems that the only handle we have on that file is to know that it is the file corresponding to the thought that *I* had at *that* time in *my past*. In other words, I need the sense contents to simply identify which file is  $f(o)$ .

There is an even deeper problem, this one involving the files themselves as opposed to our previous concern about deploying the correct file. From a non-technical perspective, the problem is this: What makes it true that the data structures/files carry the information they need to here? Does the content of such data structures come for free? It does not.

From the perspective of the foundations of the theory of computation, the information carried by the data structures cannot be grounded in the low-level physical properties of the computational system, but rather must be grounded in terms of the legibility of the inputs and outputs of the computational system, which in turn means we are interested in the legibility of the inputs and outputs *to us*. And this includes the legibility of the perspectival content that may be carried by the computational system. That content isn’t grounded in the physical properties of the system, but rather

in subjective – indeed perspectival – properties that we build the systems to encode. The perspectival properties come first, which is to say that the sense content must come first. You can't ground the sense content of the data structure without having an external anchoring of the the sense content.

This is a thesis I advanced in Ludlow (2019; Chapter 5), and while there isn't space to develop the argument here, I can at least offer the elevator pitch for those that are interested. The basic idea is that indexical content – what I would prefer to call perspectival content or interspectival content – not only figures in our accounts of human action and emotion, but it also figures in our accounts of ethics (for example I must know that something is a rule *for me*), and scientific practice at the experimental level (at the simplest level, I have to know that something is *my* experiment across time), and ultimately it grounds our accounts of information and thus computation as well (because our best theory of information is subjective and perspectival).

Information is subjective and perspectival? Yes! This is a deep point that runs through Shannon's (1948) theory of information,<sup>3</sup> and even through Boltzmann's theory of entropy in statistical thermodynamics,<sup>4</sup> on which Shannon's theory is grounded. As Galistel and King (2009) put the idea, "the information communicated by a signal depends on the receiver's (the subject's) prior knowledge of the possibilities and their probabilities. Thus, the amount of information actually communicated is not an objective property of the signal from which the subject obtained it!" In Ludlow (2009) I supplemented this idea with the observation that the information communicated is not merely a subjective property but a perspectival property as well, for there is also the matter of whether the communicated information is *for me*. That isn't an objective property of the signal either.

Following Galistel and King, we can illustrate the point with the example of the (somewhat apocryphal) story of Paul Revere, from the American Revolution. When Paul Revere sees the lights in the Old North Church he understands that the lights mean that the British are coming by land and by sea, but it is not some objective property of the lights that encodes this. It is only by his prior understanding of possible messages that Revere understands what they mean. But note also that it is not an objective property of the light signals that they carry the information that this is a message *for him*. Nor is it an objective property of the signal that it carries the information that the invasion is happening *now*. This too is something Paul Revere must know to be a possible message.

So far, I have pointed out that the information carried by a data structure is a subjective and perspectival property; it is not an objective property of the computational system. There is nothing about the lights in themselves that tell

3 See also Shannon and Weaver (1949).

4 See Boltzmann's 1886–1889 lectures on gas theory, translated and published in Boltzmann (1964).

you the British are coming. You have to know what the possible messages are. Similarly, given two data structures,  $f_1(o)$  and  $f_2(o)$ , there is a serious question of what those structures represent, and whether they represent two different sense contents is not an objective property of the data structure itself. We have to have a prior independent understanding of the sense contents.

But the problem is even worse than this, because we can also interrogate the nature of the data structure itself. By virtue of what do we have two separate data structures instead of one? Or any data structure at all? The data structures cannot be individuated by the microphysical states of the system. This is a point that is made by Kripke (1982) in his reconstruction of Wittgenstein's rule following argument, and in particular in his point that computational states can't supervene on internal low-level properties of the physical system. This needn't lead us to skepticism, however. It merely means that the very data structures of a computational system depend on the information being communicated through the system, and as with all information, this is a subjective and quite perspectival property turning on either the intentions of the designer of the system and/or whoever reads the input and output of that system.<sup>5</sup>

What this means for current purposes is that you can't ground sense content in a computational account of the mind/brain because the computational or information-theoretic account (necessary for an appeal to data structures and files) is itself anchored by sense content. In other words, data structures can't anchor sense content because we need perspectival sense content to individuate the relevant data structures. Perspectival content comes before information-theoretic content (or at least the information-theoretic content we need here). To think otherwise is to put the cart before the horse. You need an account of perspectival content before you can start talking about data structures and files that might do the work of distinguishing fine-grained thoughts that trade in indexical content.

Now, I want to make it clear that I am not at all sure Božičković would push this line about data structures as hard as I have here. My target is perhaps more correctly understood as someone who might make a herculean effort to find some object to distinguish sense contents and ground them in

5 The following passage from Kripke (1982) develops this idea.

Actual machines can malfunction: through melting wires and slipping gears they may give the wrong answer. How is it determined when a malfunction occurs? By reference to the program of the machine, as intended by the designer, not simply by reference to the machine itself. Depending on the intent of the designer, any particular phenomenon may or may not count as a machine 'malfunction'. A programmer with suitable intentions may even have intended to make use of the fact that wires melt or gears slip, so that a machine that is 'malfunctioning' for me is behaving perfectly for him. Whether a machine ever malfunctions and, if so, when, is not a property of the machine itself as a physical object but is well defined only in terms of its program, as stipulated by its designer. Given the program, once again the physical object is superfluous for the purpose of determining what function is meant. (1982: 34–35)

data structures within cognitive science. But I do want to make the point that there are no strategies that can accomplish what the advocate for such a view needs to accomplish here. The objections I have raised here will apply to any attempt to provide some object, whether *o*, or a file, or some alternative object *p* or *q* or *r* or *s*. Any attempt to execute a general strategy like that of Božičković is going to meet the same end.

There are no cognitive objects that can do the work that Božičković needs done, because we need to lean on sense content to identify them. And if we rely on sense content to identify them (as we did in the case of computational data structures), then we can't use them to ground our account of sense content – we would immediately get trapped in a vicious circle. On the other hand, if we try to rely on objects that are not cloaked in sense contents (e.g. just *o* itself), then of course they will not be fine-grained enough to account for cognitive significance.

I believe, like Božičković, that we *can* give accounts of cognitive dynamics; my point is that the theory of dynamics must do all the hard work itself, without the help of cognitive objects to anchor meaning and sense content. The Red Queen needed to keep running if she wished to stay in place. There were no places she could sit and rest if she wanted to stay in place. Our theory of cognitive dynamics must keep updating modes of expression to say the same thing, and sadly, there are no cognitive objects that can allow the theory to sit and rest if it wants to target a particular thought. Like the Red Queen, the theory must forever stay in motion.

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