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Commentary

The Mechanics of Representing Time

Christoph P. Hoerl

Department of Philosophy, University of Warwick, Coventry, CV4 7AL, UK

ORCID iD: 0000-0002-3370-4747

E-mail: c.hoerl@warwick.ac.uk

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Abstract

A number of recent attempts to explain the apparent contrast between ‘human time’ and ‘physical time’ have appealed to Hartle’s (2005) sketch of an ‘Information Gathering and Utilizing System’ (IGUS) as a model for explaining human temporal experience. I argue that they fall foul of William James’ (1890) dictum that “[a] succession of feelings, in and of itself, is not a feeling of succession”. Explaining how human beings come to represent time in the first place is a more substantive explanatory task than it is often taken to be.

Keywords

four-dimensionalism, IGUS, temporal experience, temporal representation, time, temporal updating

1. Putting the ‘Two Times’ Problem into Context

The ordinary person’s understanding of time seems replete with ideas such as that time ‘passes’ or ‘flows’, that the present moment in time is somehow objectively special, and that there is a real difference in nature between the ‘open future’ and the ‘fixed past’ (see Note 1). Yet, time as it is dealt with in modern physics appears devoid of any of these features. The four-dimensional manifold that physicists speak of as ‘spacetime’ knows no privileged ‘now’ and *a fortiori* also no objective passage of events from the future through the present and into the past. Thus, we are left with what Gruber *et al.* (2022) — following Callender (2017) — call the ‘two times’ problem: the problem of reconciling ‘manifest time’ with ‘physical time’ (Note 2).

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It is important not to overstate the ‘two times’ problem, though. As Carlo Rovelli (2018) points out, it would be a mistake to think of spacetime as an arena in which nothing ever happens. In fact, it is full of change and dynamism, if these are understood as aspects of how things are arranged *within* time, rather than some further properties of time itself. Thus, in at least some cases, it is also a mistake to deduce from the fact that aspects of experience are in some sense ‘dynamic’ that they must be at odds with the picture of time presented by modern physics (for discussion, see, e.g., Deng, 2017; Hoerl, 2014a, b). I think Gruber *et al.* sometimes fall prey to versions of this issue. No four-dimensionalist, for instance, should claim that the experience of “one color or shape [changing] into another” is illusory, as Gruber *et al.* (2022, p. 6) do. A thing having one colour or shape at one time and then having a different one at another time is a pervasive feature of the four-dimensional universe (Note 3). Similarly, it is not clear why the visual perception of motion should be seen as being illusory, as Gruber *et al.* claim, simply because perception is “discrete at a rate of 10–13 Hz” (*ibid.*, p. 7). The latter is a claim about perceptual acuity, not a claim about something being perceived that isn’t there.

In what follows, though, I want to focus on another issue, which arises before the ‘two times’ problem even gets going. Here is one way of bringing it out. Suppose there were no ‘two times’ — suppose there was an objectively special ‘now’, etc., as common sense seems to have it, just not yet accounted for by physics. Given what we know about the workings of human perception, this still leaves us with the challenge of explaining how such a feature of time could manifest itself in experience, because it is quite unlike the familiar types of things that we take to be the objects of perceptual experience (on this, see also Prosser, 2016; Skow, 2011). Indeed, even for the four-dimensionalist, there is a fundamental explanatory challenge as to how humans come to represent time at all. Sometimes this is encapsulated in the slogan that there is ‘no sense organ for time’, and even though that slogan is perhaps not the most helpful in some respects (Singhal, 2021), I think it tries to capture a genuine insight: Accounting for how human beings come to represent time is a formidable, and often overlooked, task that begins long before we get into the kinds of issues supposedly at stake in the ‘two times’ problem (Note 4).

2. The IGUS and Temporal Representation

Like a number of recent treatments trying to explain features of human temporal experience against the background of spacetime physics, Gruber *et al.* take as their starting point Hartle’s (2005) paper ‘The Physics of Now’. In this paper, Hartle sketches a model of what he calls an ‘Information Gathering and Utilizing System’ (IGUS; Fig. 1).

Hartle intentionally gives the IGUS only a very basic cognitive architecture, which is meant to be neutral between the information-processing capacities of

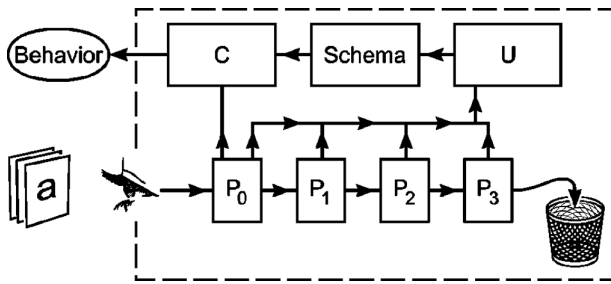


Figure 1. A schematic depiction of the IGUS (Information Gathering and Utilizing System), as presented by Hartle (2005). P_0 to P_3 are described as ‘registers’ containing information about the state of the world at different times, with such information being successively moved from P_0 to P_3 before being discarded.

a human being and those of an artificially created automaton. (He describes the IGUS as a ‘robot’.) However, he markedly departs from keeping things simple when describing the mental states supposedly generated by that architecture. He says that the IGUS

has conscious focus on the present, but only access to the past through the records that are inputs to the unconscious computation of its schema. [It] can thus be said to ‘experience’ the present and ‘remember’ the past. The ‘flow of time’ is the movement of information into the register of conscious focus and out again. [...]. The subjective past, present, and future, the flow of time, and the distinction between predicting and remembering are represented concretely and physically in the structure and function of the [IGUS] (Hartle, 2005, p. 102f.).

The first thing I want to highlight here is Hartle’s claim that “The ‘flow of time’ is the movement of information into the register of conscious focus and out again” — an idea that Gruber *et al.* (2022, p. 2) appear to endorse. As far as I understand, this is meant to refer to the information flow between P_0 and C (I will return to the other ‘registers’ not feeding directly into C later). With that in mind, notice that — contrary to what he appears to suggest in the final sentence of the passage just quoted — no state representing the ‘flow of time’ is actually depicted in Hartle’s diagram. The contents of P_0 (and thus C) do of course change over time, but each individual content only ever represents how things are at a time (Note 5). To think that there is more implied by the diagram would be to run afoul of William James’ (1890) dictum that “[a] succession of feelings, in and of itself, is not a feeling of succession”, which Gruber *et al.* themselves cite (2022, p. 7, see also Hoerl, 2013 for further discussion). Indeed, the cognitive system sketched in Hartle’s diagram seems to be best described as one that engages in mere ‘temporal updating’ rather than any form of temporal reasoning (Hoerl & McCormack, 2019). That is to say,

it simply operates with one model of the world at a time, which is then simply replaced with another model as new information comes in.

Gruber *et al.* (2022) seek to embellish the IGUS's basic architecture with further 'gadgets', and it might seem that an obvious one to add in order to address the issue I have just raised is a further awareness of the replacement of one bit of information in the IGUS 'register of conscious focus' by another. But in terms of explanation, this does not get us any further. The IGUS is presented, at different times, with different states of the world, and we want to know how, on the basis of this, it can represent time — i.e., arrive at a representation of the succession between those states. Clearly, if there is an explanatory question here, it cannot be answered by appealing to the idea that, at different times, the IGUS is also presented with different states it is itself in. That just raises exactly the same question again in a different guise (Note 6). If there is a question about how it is possible for an individual to represent succession, this question arises equally for the succession between the events they perceive as well as the succession between their own perceptual states.

So far, I have left out what happens further towards the right in Hartle's diagram — the registers P_1 – P_3 that supposedly house information about past events. Hartle himself stipulates that these only feed into unconscious processing. That alone seem to make them unsuitable for figuring in the kind of explanation of manifest time sought by Gruber *et al.* But I think it also implicitly recognizes a more fundamental problem. In general, the ascription of a state with a certain representational content to an individual has to earn its keep by there being an account of the functional role that state, qua carrying that particular representational content, serves within the cognitive architecture of that individual. As characterized, though, what is important for the IGUS is just how to act now. In deciding how to do so, it draws on information concerning the current state of its world plus what Hartle calls 'schemata' — an idea of how things go generally. As Hartle's diagram has it, these 'schemata' are based on experiences the IGUS has over time, but the idea that the IGUS also retains representations of these individual experiences in 'registers' simply washes out — it plays no explanatory role.

To provide an illustration of the issue at stake, consider Édouard Claparède's (1911) famous experiment in which he pricked one of his amnesic patients with a pin hidden in his hand. Subsequently, the patient showed no recollection of the incident, but refused to shake his hand again, on the grounds that "sometimes people hide pins in their hands". We need an explanation as to why we are not all in the same predicament as this patient. Yet, Hartle's model of the IGUS does not supply any such explanation. The past is gone and will not come back, so there is a real challenge to explain why human beings retain memories of particular past events as such, rather than just general knowledge derived from past experience, and what role this ability plays in their cognitive lives — a challenge which is not adequately addressed simply by adding to their cognitive architecture some

‘registers’ in which information acquired in the past (‘images’, as Hartle calls them) can supposedly be stored (Note 7).

3. Concluding Remarks

Daniel Dennett (1991) provided a trenchant critique of what he called the ‘Cartesian Theatre’ — a picture of the mind that may initially exert a powerful grip on intuition but ultimately explains nothing because it presupposes the very capacities it purports to explain. I believe something similar is the case with the model of the IGUS provided by Hartle that Gruber *et al.* (2022) draw on. Hartle’s scare quotes in claims like “The [IGUS] can thus be said to ‘experience’ the present and ‘remember’ the past” (Hartle, 2005, p. 102) elide the very questions about temporal representation his account is meant to address. They illicitly import our own understanding of the workings of the IGUS over time into a description of its own supposed representational states.

Notes

1. For some (qualified) empirical support for these claims about people’s ‘intuitive theory’ of time, see Lee *et al.* (2022) and Shardlow *et al.* (2021).
2. Callender’s inspiration in coining this issue are the ‘two tables’ as described by Eddington (1928) — one presented in everyday experience as, e.g., coloured and solid, and one as described by physics as made up of fields of force.
3. As a reviewer points out, this leaves open how exactly perceptual experience represents the way in which things exist over time — an issue highlighted by Prosser (2012). I will set this issue aside for current purposes.
4. On this, see, e.g., Hoerl (2008) and Hoerl and McCormack (2019).
5. As mentioned above, the contents of C are also influenced by what Hartle calls ‘Schemata’. I will discuss this element of his account below.
6. On this, see, e.g., Hoerl (2017).
7. For a variety of potential attempts to address this challenge, see Henry and Craver (2018), Hoerl (2008), Hoerl and McCormack (2005, 2016) and Mahr and Csibra (2017).

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