

## Full Series of Notes to PSYCHE-D

### Introduction

Below is the full, unabridged series of notes (posts) I contributed to the moderated mailing list PSYCHE-D in late 1997 – early 1998.<sup>1</sup> These may constitute the earliest widely disseminated example of how a self-model approach that places motor output, sensory-motor coordination and related error correction at its centre can be applied to questions of how consciousness arises and which speaks to an associated real time *mechanism*.

The notes for 29 December, 30 December, 7 January and 31 January in their entirety are additional to the material already provided in the Introductory Summary<sup>2</sup>. Beyond this, there is additional material within the entries for 1 January, 2 January and 24 January.

### Posts

27 Dec 1997

Posts recently have discussed the issue of "appearances" versus "underlying reality". I believe correct resolution of this issue could turn out to be the first step toward development of an information processing theory able to explain how consciousness is produced.

Even so, effective analysis of the relationship between what posts have called the "dark world" (McKenzie 15-Dec-97) and the private world each of our brains discretely construct from sensory input received from that dark world, probably will require development of a precise notation and a tightly structured initial case describing relevant information flows. Here, for comment, is such a notation and initial case:

- 1) Assume there exists independent of any observing subject, a single universe, U, which contains all things, including all human beings.
  - 1a) Any alternative to (1) would require adoption of an idealism or a solipsism.
- 2) If it is accepted U exists in its own right, then a *component* of U - call it the noumenal world, W[r] - can then be defined, where W[r] is the observer-independent component of U.
  - 2a) W[r] will be the world underlying appearances but not including appearances. Thus, W[r] will be where information capable of sensory perception comes from, regardless of whether there are observers present to perceive that information. (I prefer to call W[r] the noumenal world because it essentially is U purely at the level of Kant's noumena (see "The Critique of Pure Reason" and, specifically, the Transcendental Aesthetic).)
- 3) The component of a person which is manifest at the level of W[r] can be called their noumenal body, B[r].
  - 3a) Similarly, there will be a component of a person's brain manifest at the level of W[r], call it brain[r]. Also, there will be trees[r], rocks[r], beetles[r] and so on. (These examples introduce use of the suffix [r] to denote the "noumenal component" of any entity or process.)

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<sup>1</sup> Sourced from <https://archive.org/details/PSYCHE-D>. Some minor formatting adjustments have been made for ease of reading. Footnotes were not in the original posts and are added here to provide clarification, commentary or any subsequent revision of views.

<sup>2</sup> See [https://teleodyne.com/intro\\_summary.html](https://teleodyne.com/intro_summary.html)

- 4) A person's conscious experience of themselves as they act in the world will be generated by processes[r] in their brain[r] which inter alia use real-time sensory input flowing from W[r] into B[r]. Their brain[r] must use that sensory input to generate, for its internal purposes - including conscious sensory perception, and the conscious planning and execution of physical acts - a dynamic *real-time* representation of B[r] in W[r] which can be called B[i] in W[i]. Call W[i] the "world image" and call B[i] the "body image".
- 4a) Your B[i] will be your body as you consciously perceive it, and W[i] will be the world you perceive as containing your body and all other physical things. Thus, *importantly* W[i] will be what you refer to as "the physical world". W[i] will contain your brain[i], and also trees[i], rocks[i], beetles[i] and so on.

(These examples introduce use of the suffix [i] to denote the "phenomenal component" of any entity or process. Note that any entity[r] will lead to a subjectively perceived entity[i] unique to each observer. Thus, in the presence of a table, what you see as the table will be your table[i] and what I see will be my table[i]. (A distinction of this type was made in McKenzie 24-Dec-97).)

The idea that conscious experience of the self-in-the-world must rely on brain[r] generating a real-time representation of B[r] in W[r] is logically necessary.

Consider the following example: View the ceiling over your head. You know that you are able to see the ceiling only because light travels from it into your eyes, where incoming light patterns are then translated into neural impulses. But if that is true, how can the ceiling appear subjectively to you to be outside and above your head, rather than inside your brain, where those neural impulses are being processed? The reason can only be that information[r] is passing from ceiling[r] via your eyes[r], into your brain[r], where it is being processed such that you subjectively can experience that information as ceiling[i] which you perceive as being some distance outside and above your head[i]. The only efficient explanation can be that, the whole time, head[i] and ceiling[i] are inside W[i] which, at the level of information processing, *is inside* your brain[r]. (W[i] is *inside* your brain[r] by virtue of having been generated by your brain[r], within your brain[r], through brain[r] processing of sensory input[r].)

The initial case provided above forms a departure point for a host of separate analyses, some more to do with metaphysics than with consciousness. In relation to consciousness, one particularly interesting direction is:

- 5) If a person consciously experiences themselves in real time as B[i] in W[i] then there must be a set of processes in brain[r] which maintain *in real time* a high level of *fidelity* between the image level of B[i] in W[i] and the noumenal level of B[r] in W[r].
- 5a) That must be so, or a person's capacity for normal sensory-motor coordination would fail. Why would it fail? Because each physical *action* we make must first occur at the noumenal level of B[r] acting upon W[r], and then be followed, on a second-by-second basis, with monitoring at the level of B[i] in W[i] for confirmation that the action is proceeding as planned. If something is seen to be going wrong with the action as it is reflected in B[i] in W[i], then *conscious* correction of that action can take place. Thus, as suggested, if in real time the dynamic representation B[i] in W[i] did not with adequate fidelity reflect the dynamic situation of B[r] in W[r] we would be unable to practice effective sensory-motor coordination.
- 6) If there is a process in brain[r] responsible for maintaining real-time fidelity between B[i] in W[i] and B[r] in W[r], then that process may have a refresh rate, or perhaps even a refresh frequency. That is, there may be a frequency with which B[i] in W[i] is updated to reflect changes in B[r] in W[r].

(Although that rate seems unlikely to be as fast as Professor Crick's 40 Hertz (40 times per second), it could be an integral fraction of 40 Hertz, possibly 10 Hertz (see below).)<sup>3</sup>

<sup>3</sup> I now believe 10 Hertz is likely to be too fast and - based on neurological studies - that 4 Hertz is a better estimate.

How might all of this lead to a description of the processes by which consciousness itself is generated? Well, to really push the envelope, consider the following:

- 7) A subjective, moment-by-moment sense of consciousness may be generated through an error-correction process in brain[r] which at a rate of about 10 Hertz *realigns* (i.e. error corrects) a person's B[i] in W[i] (the physical world as they perceive it) to update it back to high fidelity (i.e. to bring it back into "register") with their B[r] in W[r] (the world as they act upon it).<sup>4</sup>
  - 7a) The genesis of consciousness might then take place at about 10 Hertz<sup>3</sup>, when each realignment to bring B[i] in W[i] back to high fidelity with B[r] in W[r] leads to the possibility of an information processing arrangement in brain[r] able operationally to assume that B[i] in W[i] is *in identity* with B[r] in W[r].<sup>5</sup>

In other words, consider that, on a moment-by-moment basis, consciousness might arise through brain[r] processes which manipulate information on the operational premise that the self as it perceives itself (B[i] in W[i]) is one and the same as the self as it acts (B[r] in W[r]).

A derivative (inverted form) of what I am proposing then, is that it will be a necessary condition of consciousness that a person should not be capable of any immediate form of subjective awareness of a distinction between their body as they perceive it (their B[i]) and their body as it acts (their B[r]). And, indeed, experience shows that an utter lack of ability to distinguish B[i] from B[r] is the norm. (That is why the initial case provided above in points (1) to (4) is *not* self evident, and can only be shown to be necessary by application of sustained abstract reasoning.)<sup>6</sup>

A further observation in support of deriving points (7) and (7a) from (6) is that consciousness itself appears subjectively to have a rate. We cannot easily consciously perceive the slow movement of the big hand on a clock or see the fast flight of a bullet. But we do see the movement of a clock's second hand quite well, and if it has a stepped movement we subjectively can mark each second as it passes. Using an analogue stop watch with a stepped movement though, it is very difficult consciously to mark the passage of each tenth second. That rough "titration" of capacity for subjective awareness of shorter and shorter frequencies of movement, supports the idea that brain[r] processes responsible for consciousness have a summed rate within an order of magnitude of a tenth of a second. (Reasoning behind that assertion includes that any system which has a frequency x, can interact in a complex manner with systems which impinge upon it and have a frequency comparable to x, but can interact only crudely if those impinging systems have a rate either much greater or smaller than x.)

Points (7) and (7a) may seem far fetched. There is a properly reasoned case to be made for them, but it is much too long to post to Psyche D<sup>7</sup>. Meanwhile, I hope that in their bald state (7) and (7a) will prove stimulating.

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<sup>4</sup> There are really two forms of correction process being referred to at once here, hence the use of the terms "realigns" and "error corrects". In the more advanced descriptions provided elsewhere on this website, these two forms are resolved into (1) the updating of {B[i] in W[i]}<sup>a</sup> to {B[i] in W[i]}<sup>(a+1)</sup> in a 'realignment' to bring B[i] in W[i] up to speed with any change going from {B[r] in W[r]}<sup>a</sup> to {B[r] in W[r]}<sup>(a+1)</sup> and (2) estimation of the prediction error, {B[i] in W[i]}<sup>(a+1)E</sup> – defined as {B[i] in W[i]}<sup>(a+1)</sup> Δ {B[i] in W[i]}<sup>(a+1)\*</sup> – which occurs in the same beat of the action cycle and which is the difference between a *predicted* change in {B[i] in W[i]} and the subsequent *observed* change in {B[i] in W[i]}. This prediction error is used to update the association matrix. These two interdependent processes are described in the note *How is Free Will Possible?* pp5-6 at [https://teleodyne.com/free\\_will.pdf](https://teleodyne.com/free_will.pdf), and correspond to Step 3 and Step 4 as described at pp57 in [https://teleodyne.com/main\\_essay.pdf](https://teleodyne.com/main_essay.pdf). These ideas can also readily be recast in terms of *active inference* within the predictive processing paradigm. See, for example, in Hohwy, J. (2014) *The Self-Evidencing Brain* *Nous* 50 259-285 and Hohwy, J. (2020) *New Directions in Predictive Processing*, *Mind & Language* 35, 209-223 and references therein.

<sup>5</sup> This inductive, "operational assumption", is at the heart of genesis of a moment-by-moment, subjective sense of being a physical self in a physical world, as per pp 7-8 in the note *How is Free Will Possible?* at [https://teleodyne.com/free\\_will.pdf](https://teleodyne.com/free_will.pdf).

<sup>6</sup> This inability of a conscious subject to have any immediate form of subjective awareness of a distinction between their body as they perceive it (their B[i]) and their body as it acts (their B[r]) is what has been characterised by Thomas Metzinger and others as the property of "transparency" in relation to the operation of phenomenal self-models able to deliver consciousness.

<sup>7</sup> This case had been made in Hammer, B. C. *A Theory of the Genesis of Self Awareness* 1997 – see [https://teleodyne.com/main\\_essay.pdf](https://teleodyne.com/main_essay.pdf) – which was provided in July 1997 in bound copy to Paul Churchland, Ned Block, Daniel Dennett, Paul Davies, Douglas Hofstadter, Thomas Nagel, Roger Penrose, John Searle and several others.

Alfredo Pereira asked (28-Dec) how ideas expressed in my post of 27-Dec might be reconciled with what he has called the "paradox of non-locality" (PNL) (and see Pereira 13-Dec).

If I understand the PNL properly, it draws attention to the apparent anomaly that some of the processes taking place *inside* a person's brain can be, and are, consciously perceived by that person as processes or entities located *outside* their body (and therefore, outside their brain). Specifically, the PNL asks how processing of *sensory information* (which takes place *inside* a person's brain) can lead a person to perceive entities and processes as existing some distance away *outside* their body.

I believe the initial case developed in Hammer 27-Dec handles the PNL well. To recap briefly, Hammer 27-Dec argued that there is a noumenal world, W[r], defined as that component of the world which will exist, and will generate information capable of sensory perception, regardless of whether any observer is present to detect, and thereby perceive, that information. All physical entities and processes capable of being perceived will have a component at the noumenal level (that is, they will have a "noumenal component"). An entity or process's noumenal component can be denoted using the suffix [r]. Thus, there will be rocks[r], trees[r] and tables[r] in W[r]. The noumenal component of a person can be called their noumenal body, B[r].

On that basis there seem two ways to seek to reconcile the PNL with the ideas presented in Hammer 27-Dec. The first, which is rather mechanical, makes as few additional assumptions as possible, and relies on tracing the relevant flow of information:

Say a person is seeing a stone (and is not hallucinating). Information[r] capable of sensory perception by their B[r] will be emanating from stone[r]. Call that information "visual". (Here "visual" means only that the information can enter B[r]'s brain[r] after processing[r] in B[r]'s eyes[r], to then be processed by a "visual processing area"[r] in brain[r] which to some degree will interact with a "consciousness generating area"[r] in brain[r].)

The case made in Hammer 27-Dec was that processing[r] in brain[r] will then be responsible for *generating* a "stone image", denoted stone[i], as a component in a perceived world, or "world image", W[i]. Thus brain[r] processes[r] will generate stone[i] as part of W[i]. W[i] will also contain a "body image", B[i]. B[i] will be the component of W[i] which brain[r] generates by processing sensory information[r] emanating from B[r] (including proprioceptive information). To complete the account, at any given moment W[i] will contain *no more and no less* that that which brain[r] is able at that moment to put into it on the basis of brain[r] structures[r] and processes[r] in interaction with momentary incoming sensory information[r].<sup>8</sup>

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<sup>8</sup> These posts make fairly free reference to objects at the absolute level - for example to a rocks[r] or a beetles[r]. One criticism may be that to refer to objects at the absolute level as if they were well known is unsustainable since things[r] could be considered equivalent to Kant's 'things-in-themselves' and should therefore be 'unknowable' (Stace, W. C. *The Philosophy of Hegel* p69-78, Dover Publications, New York, 1955). In fact, the view advanced more broadly on this website is that a key aspect of the development of physical self awareness is development in the individual of a high-fidelity familiarity with objects[r] through practical sensory-motor experience with them at the level of objects[i]. Indeed, in the hypothesis developed, physical self awareness is considered to arise in the course of a progressive - but never quite complete - movement towards a situation where B[i] in W[i] approaches a perfect representation - *for all practical behavioural purposes* - of B[r] in W[r]. For this reason, when objects[r] enter into discussion, the subject - unless it is otherwise stated - is assumed to have considerable knowledge of them. True, it is knowledge at the level of representations, *but these are very good representations* by virtue of having been, and still continually being, operationally tested for their fidelity to the objects[r] which they respectively represent.

Bearing the foregoing in mind, the PNL takes the form of asking where exactly the stone is located or, perhaps more importantly, where exactly the physical body of the observer is located. The answer is that what you consciously *perceive* to be your body (or for that matter what you perceive to be a stone or a violin) will *at the level of information processing* always be "located" "inside" your brain[r]. (In other words, entities or processes will only ever be consciously perceived as entities[i] or processes[i].)

A way to try to grasp this point intuitively is to sit back, look around, and focus on the idea that everything you see – even into the far distance – is a reconstruction (B[i] in W[i]) taking place in real time within your brain[r].

(That reconstruction will be taking place (1) on the basis of the sensory information[r] your brain[r] is receiving in real time, and (2) in interaction with, and by virtue of, your brain[r]'s structural[r] and information processing properties (including, for example, the noumenal components of such entities/processes as make up the various types of "memory").)

A second, deeper approach to reconciling the PNL with Hammer 27-Dec recognises that lurking at the foundations of the PNL is the intuitively difficult issue of how to relate the concept of space to the concepts of noumenal and phenomenal worlds (W[r] and W[i]) which have been developed. Put superficially: Where are objects[r], including brain[r], located in space? Or, in more fundamental terms:

Q1) Are there such things as space[i] and space[r]?

I am pretty much convinced there is no such thing as space[r], and I am fully convinced that if there *is* some kind of space[r], it will turn out to be quite unlike the space[i] which we perceive. There are a number of ways of arguing this position, but the most efficient non-empirical case probably remains Kant's ("Critique of Pure Reason", Transcendental Aesthetic, Section 1). (In radical shorthand, perceived empty space has no information content (i.e. contains nothing empirical), and thus space can be seen as a brain[r]-generated "precondition" for the conscious perception of sensory information[r] as presented to consciousness as entities[i] and processes[i] *in* space.)

So while brains[i], along with other entities[i] and processes[i], are perceived as having extension and location in space, I would contend that their noumenal components (i.e. brains[r] and other entities[r] and processes[r]) *need not have any such extension or location* (though they may have "something about them" that is communicated via sensory information[r] which "translates" into a subjective perception of their extension and location). This position obviates any PNL requirement to explain where entities[r] or processes[r] are spatially located. (Obviously there are some physics issues here - perhaps including the nature of delocalisation of subatomic particles and of long-distance quantum-entangled states – but those will have to wait for another day.)

What then can be meant by my earlier assertion that:

- > what you consciously *perceive* to be your body
- > (or for that matter what you perceive to be a
- > stone or a violin) will *at the level of*
- > *information processing* always be "located" "inside"
- > your brain[r].

Well, *all* that is being assumed in this and other statements about happenings in  $W[r]$  is that in a time ordered manner, information[r] is being transferred from one entity[r] to other entities[r] at the noumenal level, and that it can also be processed "within" (i.e. "by") some of those entities[r]. More specifically, I am asserting that when a person is conscious, some of the information[r] processing being done by their brain[r] leads to the genesis of a moment-by-moment subjective perception of a  $B[i]$  in  $W[i]$  which takes the subjective *form* of a spatial distribution of entities[i] and processes[i] having extension in space. That form need not be the form taken in  $W[r]$  by the noumenal components of those entities and processes.<sup>9</sup>

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<sup>9</sup> The challenges associated with the idea of space[r] are only touched upon here and in the post of 7 January 1998. These challenges deserve more consideration and will be the focus of a forthcoming note. Meanwhile, a perspective similar to that suggested here and at the post of 7 January is given in Ismael, J. *Do You See Space? How to recover the Visible and Tangible Reality of Space (Without Space)* at: <https://www.jenanni.com/papers/HowtoRecovertheVisibleandTangibleRealityofSpace.pdf>

30 Dec 1997

Thanks to respondents for your interest, comments and kind words regarding the original post. Duncan McKenzie's (28-Dec) idea of using [i] and [r] seems a good one, so I'll adopt it.<sup>10</sup>

In response to comments:

Alfredo Pereira (29-Dec) noted my 29-Dec claim that:

- > ...when a person is conscious, some of the information[r]
- > processing being done by their brain[r] leads to
- > the genesis of a moment-by-moment subjective perception
- > of a B[i] in W[i] which takes the subjective *form* of
- > a spatial distribution of entities[i] and processes[i]
- > having extension in space. That form need not be the
- > form taken in W[r] by the noumenal components of those
- > entities and processes.

And he asked:

- > a) Is this "subjective form" 'a priori', in the Kantian sense, or does it have a neurobiological basis?

I believe that space is 'a priori' in the Kantian sense *and* that it has a basis in neurobiological[r] processes. To sustain that position I assume that an individual's neurobiology[r] precedes their consciousness (i.e. that the right neurology[r] and neurological[r] processes have to exist in order for the B[r] which has that neurology[r] to experience consciousness of B[i] in W[i].)

- > b) Why does this form avoid perceptual self-reference?

I'm not really sure what this question means, but would simply repeat that I do not assume that W[r] consists of objects[r] distributed in space[r]. I don't think there need be any such thing as space[r].

If the question is asking why an object[i] does not appear to the person perceiving it to be located at the brain[i] site corresponding to the brain[r] structure/process[r] which creates that perception, my response would be to ask: Why should it? (When you watch the chariot race in Ben Hur on television, where is the chariot race?)

- > c) How is it possible for the subjective spatial
- > distribution of entities[i] and processes [i]
- > to be useful for the control of actions performed in W[r]?

This is a good question. To avoid a complicated literal explanation I will go straight to a metaphor and reformulate the question as:

"How is it possible during darkness and fog for a control panel full of lights and gauges to be useful to a pilot trying to land an aircraft?"

In relation to Alfredo's closing comment on Kant and evolutionary adaptation, I would *certainly* assume that development of brain[r] ability to generate consciousness of B[r] in W[r] in the form of a spatially distributed representation, B[i] in W[i], is driven by evolutionary adaptation. To extend the metaphor just used, I would say that the gauges and lights on the instrument panel have evolved into an arrangement which is *very* effective for the purposes of flying the plane.

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<sup>10</sup> To make reading easier, this notation has been applied retrospectively to cover the earlier posts in this record.

Peter Gonda (30-Dec) and Duncan McKenzie (30-Dec) have sought to identify latent errors in Hammer (27-Dec).

The points from that post which they focus upon are in what I have called the initial case, and are:

- > 1) Assume there exists independent of any observing  
> subject, a single universe, U, which contains all  
> things, including all human beings.
  
- > 1a) Any alternative to (1) would require adoption  
> an idealism or a solipsism.
  
- > 2) If it is accepted U exists in its own right, then  
> a *component* of U - call it the noumenal world, W[r] - can  
> then be defined, where W[r] is the observer-independent  
> component of U.
  
- > 2a) W[r] will be the world underlying appearances but  
> not including appearances. Thus, W[r] will be where  
> information capable of sensory perception comes from,  
> regardless of whether there are observers present to  
> perceive that information. (...)
  
- > 3) The component of a person which is manifest at the  
> level of W[r] can be called the noumenal body, Br.
  
- > 3a) Similarly, there will be a component of a person's  
> brain manifest at the level of W[r], call it brain[r]. Also  
> there will be tress[r], rocks[r] and beetles[r]. (...)
  
- > 4) A person's conscious experience of themselves as they  
> act in the world will be generated by processes[r] in their  
> brain[r] which inter alia use real-time sensory input  
> flowing from W[r] into B[r]. Their brain[r] must use that  
> sensory input to generate, for its internal purposes  
> - including conscious sensory perception, and the  
> conscious planning and execution of physical acts - a  
> dynamic *real-time* representation of B[r] in W[r] which can  
> be called B[i] in W[i]. Call W[i] the "world image" and call  
> B[i] the "body image".
  
- > 4a) Your B[i] will be your body as you consciously perceive  
> it, and W[i] will be the world you perceive as containing  
> your body and all other physical things. Thus,  
> *importantly* W[i] will be what you refer to as "the  
> physical world". W[i] will contain your brain[i], and also  
> tress[i], rocks[i], beetles[i] and so on.

I believe Peter's and Duncan's concerns can be resolved through clarification of what is meant to be implied by those points.



First, (1) was designed to force a choice between idealism/solipsism and materialism and, at the same time, to bind that choice to the conclusion that if idealism/solipsism is to be rejected then, *at the least*, it must be accepted that there is *some* component of U which is observer-independent. Defining that component as W[r] completes the purpose of the first two points.

In other words U is simply a generous device for enabling clear definition of W[r]. I therefore have *no objection* to setting the component of U allotted to W[r] to 100 percent, as suggested at the conclusion of McKenzie (30-Dec). Nor do I object to people choosing to assume that U is "an inert and impotent token" (Duncan's anti-euphemistic description of what I have just called "a generous device"). To do either does not affect the intended meaning of points (1) to (4a).<sup>11</sup>

Secondly, I would have thought the initial case made quite clear the relationship between W[r] (there is only one of those) and the *experience of one's self as a B[i] in W[i]*, which I consider to be generated by processes[r] in the respective brain[r]s of conscious B[r]s.

W[r] is the foundation. Each person[r]'s conscious experience of their B[i] in W[i] will be *preceded* by the existence in W[r] of their brain[r] and the brain[r] processes[r] needed to support the genesis of their consciousness.

Thus, I would maintain that if a person[r]'s brain[r] gets crushed[r] then their conscious experience of themselves as B[i] in W[i] (and for that matter the rest of their conscious experience) is ended. In other words, the genesis of a person[r]'s conscious experience of themselves as a B[i] in W[i] will be made possible by the development of their brain[r], and will permanently be lost at their death with the cessation of those brain[r] function[r]s needed to generate their consciousness.

All of this is to say that I *in no way* intended to propose that any individual[r]'s conscious experience of themselves as a B[i] in W[i] somehow generates an independent ethereal W[i] which exists along side and co-equal to W[r] in what Duncan has quite satisfactorily called the "metauniverse U".

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Now, consider the following new points about the relationship between individual[r]'s perceived worlds (i.e. their W[i]s) and the noumenal world, W[r].

I will begin with a point 8, since these points extend Hammer (27-Dec). They lead on directly from point (4a) above, and relate to issues touched upon in the recent thread, "Consciousness". They particularly relate to McKenzie (16-Dec).

- 8) When people, including scientists, refer to the "physical world", what we are referring to is that which we collectively agree to be the contents of our respective W[i]s.
  - 8a) We reach agreement on the contents of our respective W[i]s by use of language and, for quantitative purposes, by use of agreed measuring procedures.
  - 8b) We can reach collective agreement on the contents of our respective W[i]s not only because our respective B[r]s each inhabit and receive sensory input[r] from the same (and the only) W[r], but because each of our brain[r]s probably have similar mechanisms[r] and structures[r] for processing[r] that sensory input to form those respective W[i]s.

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<sup>11</sup> Although not directly relevant to the contents of these posts, U does have utility – for example – in accommodating the Many Worlds interpretation of quantum mechanics. Here U can be understood to contain all of the *many* W[r] that would arise through decoherence and could never interact with one another. Ref: Everett, H. (1957). Relative State Formulation of Quantum Mechanics. *Review of Modern Physics* 29, 454–462 and De Witt, B and Graham, N. (eds.). *The Many-Worlds Interpretation of Quantum Mechanics*. Princeton University Press, Princeton New Jersey 1973.

- 8c) Thus, through collective agreement, we form a view of ourselves as *inhabiting a single, shared physical environment*. In other words, whomever you are, you believe that the physical world you experience - your W[i] - is one and the same, by agreed measuring procedures and by all perceived contents, as the physical world which all others experience (i.e. *their* respective W[i]s).

Again, W[r] remains the foundation. It is important however, to recognise that our physics, and the rest of our collectively agreed knowledge of the physical world, consists of a collective agreement about what makes up the contents of our respective W[i]s.

That collective agreement will powerfully reinforce our intuition that what we perceive really *is* in identity with what is "out there" in W[r]. That reinforcement will exist regardless of how much of what we collectively agree to be the contents of our respective W[i]s is in fact a collectively experienced artifact of the neurological architecture[r] and processing arrangements[r] common to each of our brain[r]s as they go about generating our respective consciousnesses.

In relation to points made in Hammer (30-Dec), I would argue that perception of W[i] as a spatial continuum is an artifact of common neurological architecture[r] and processing arrangements[r], and does not reflect a property of W[r].

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Duncan McKenzie (28-Dec) asked:

- > How do we represent the function that describes the
- > relationship between object[r] and object[i]?

I believe this to be an important and fundamental question. In short, I think it likely that we cannot know what the function is, but that we can know what the function is designed to achieve, and how well it is achieving it.

(This is a form of the general case that there is no such thing as absolute "truth" in ideas, there are only relative degrees of utility. (i.e. and more simply, the proof of the pudding is in the eating.))

I believe McKenzie's function is being refined by evolutionary forces acting on B[r], to develop brain[r]'s capacity to produce a sense of consciousness of one's self as a B[i] in W[i], such that that B[i] in W[i] converges on the most *operationally efficient* (that is what I have meant by "highest fidelity") representation possible of B[r] in W[r]. "Operationally efficient", in the sense that conscious experience of yourself as B[i] in W[i] will effectively be a *working hypothesis* of the situation of your B[r] in W[r] - a working hypothesis upon which you will predicate all of the conscious, voluntary physical actions which you make.

If the "hypothesis" which is your experience of yourself as B[i] in W[i] fails, (i.e. if Duncan's "function" proves inadequate) sensory-motor coordination errors will occur.

Duncan also wrote:

- > An object[i] derives from an object[r] in World[r].
- > But object[i] also has an existence in World[r].
- > How do we notate this?

In the arrangement I have described, an object[i] can only arise as a part of the contents of a W[i] being experienced by a particular conscious B[r]. To that extent, the relationship between an object[i] and object[r] can *only* be one where object[r] is the source of information[r] received by the senses[r] of the B[r] in question, and where that information[r] is used by that B[r]'s brain[r] processes in generating that B[r]'s conscious experience of itself as a B[i] in W[i]. In that way B[r] can be conscious of object[i] as part of the contents of its W[i]. Only through that process can an object[r] be connected to an object[i].

A further question was:

- > Is there a limit as to what objects in World[r] can
- > be discussed - including through use of this notation?

Apart from the complex issue of whether there is such a thing as space[r] (Hammer 30-Dec), I think that provided an object[i] exists for one or more observers it can be discussed as either having (or, in the case of a hallucination, not having) a "counterpart" object[r].

An object[r] *usually* can only be inferred from the perception of an object[i]. Even so, the possibility of objects[r] and processes[r] which cannot be perceived as objects[i] or processes[i] makes for interesting analysis. Indeed, postulating that certain objects[r] and processes[r] must exist, despite the fact that those objects[r] and processes[r] may be incapable of perception as objects[i] or processes[i] is what much of modern science seems to be about.

For example, no chemist of any standing would now seriously propose that atoms do not exist. But there are no such things as atoms[i]. Hence, the leap which is made when scientists choose to perform experiments on the basis that atoms exist, really does seem to be made on the basis that atoms[r] exist. (And, of course, the way in which experimental results have been used cumulatively to reinforce the *hypothesis* that atoms[r] exist, despite the absence of atoms[i], would make a study in its own right.)

Moreover, and in respect of the issue of space (Hammer 30-Dec), I consider it important that a number of those entities[r] which are now considered indispensable to physical theory and which *cannot be directly observed as entities[i]* are realised to be incapable of being understood if the scientists working on them use theories which treat space in a way which is consistent with the version of space which we seem consciously to encounter as we experience ourselves as a B[i] in W[i].

Specifically, I have in mind long-distance quantum entangled systems, systems involving delocalised subatomic particles (e.g. systems where tunnelling occurs), instantaneous changes and indeterminacies in the quantum states of subatomic and other particles, and the viability of entities such as the event horizon on black holes.

Ideas generally rise or fall depending upon whether they have internal logical consistency *and* upon their relative explanatory power. As a demonstration of the explanatory power of ideas described in Hammer (27-Dec and 1-Jan), the purpose of this post is to show how they can be used to solve a classical form of the Mind-Body Problem (CMBP).

The CMBP asks for an explanation of the relationship between "physical events" and "mental events". Mental events have been characterised as including such things as emotions and desires, which are considered to take place privately and "within" a person. Physical events have been characterised as things which can publicly be observed, and which take place in what is commonly referred to as the "physical world". More simply, in the CMBP any event which a person consciously experiences and which they cannot ascribe to the physical world is called a mental event.

Here is how ideas from Hammer (27-Dec and 1-Jan) explain the CMBP. First, consider the previously presented points:

- > 4a) Your B[i] will be your body as you consciously
- > perceive it, and W[i] will be the world you perceive
- > as containing your body and all other physical
- > things. Thus, *importantly*, W[i] will be what you
- > refer to as "the physical world". (...)
  
- > 8) When people, including scientists, refer to the
- > "physical world", what they are referring to is that
- > which we collectively agree to be the contents of our
- > respective W[i]s.
  
- > 8a) We reach agreement on the contents of our
- > respective W[i]s by use of language and, for
- > quantitative purposes, by use of agreed measuring
- > procedures.

Those points can be extended as follows:

- 9) Assume that for each B[r], consciousness is generated by a specific information processing system[r] within their brain[r]. Call that information processing system[r] D[r].
  - 9a) As (4a) describes, the form in which the physical world will present itself to a person's consciousness will be as their B[i] in W[i]. Now, in the hypothesis being described, conscious perception of the self as B[i] in W[i] will be generated within brain[r] - including by operations[r] of D[r] - through brain[r] processing of sensory information[r] coming to brain[r] via sensory pathways[r] from W[r]. Call that incoming sensory information[r] "s".
  
- 10) The apparent "non-physical" character of mental events can then be explained by assuming that brain[r] does not *only* pass s into D[r], but also passes D[r] *other* information. Call that other information "non-sensory information[r]" or "o". Thus, input to D[r] of o would create the possibility of a person consciously perceiving *more* than B[i] in W[i].

- 10a) A person's conscious perceptions due to o input to D[r] would *have* to appear to them to be non-physical - that is, "mental" - in character, because such conscious perceptions could not form part of the contents of their B[i] in W[i]. Contents of their consciousness due to o could not be perceived as part of the contents of their B[i] in W[i] because their B[i] in W[i] will be generated by brain[r] processing of s, *not* of o. And recall from (4a) that it is B[i] in W[i] which a person consciously perceives to be the physical world.
- 10b) Recall also (8-8a) that when all of us discuss the "physical world", what we are referring to is that which we collectively agree to be the contents of our respective W[i]s. That will mean that in discussion with others of our conscious perceptions due to o input, we will be *unable* to refer to such perceptions as being physical in nature.

(Certainly it will be possible to *attribute* such perceptions to neurological[r] events[r] (which scientists can study as collectively agreed contents of a set of respectively observed neurological[i] events[i]). But that would be to describe a basis or "cause" for the perceptions and not - as is meant here - to describe those perceptions as they actually are consciously experienced.)

Such perceptions therefore will have to be referred to as non-physical - that is, as "mental". By that reckoning, desires, emotions and other mental events would be examples of contents of conscious generated through D[r] processing of o input.

There is a relationship between the case developed above and questions Alfredo Pereira has asked about the location of physical events.

Alfredo's concern has been to know why physical objects[i] and events[i] are not consciously experienced as being located in those parts[i] of brain[i] corresponding to those parts[r] of brain[r] responsible for processing the s coming from those objects[r] and events[r]. The relationship between that concern and the case developed above lies in how to answer the question of why - if there are brain[r] events[r] responsible for the experience of emotions, desires and other "mental events" - those mental events are consciously experienced as having *no location in space whatsoever*.

In other words, why can we not perceive such events as being part of the contents of space? According to the conceptual framework presented in this and my previous posts, the answer is that space as we consciously experience it probably reflects part of the architecture of the brain[r] s processing[r] manifold which makes consciousness of the self as a B[i] in W[i] possible. But if that architecture is affiliated only with brain[r] processing[r] of s, then contents of consciousness due to D[r] processing of o will be left outside space. And that is what we subjectively observe with emotions and other mental events.

Arnold Trehub on 31-Dec-97 wrote:

> Brendon Hammer wrote on 30 Dec 1997:

>> ... I do not assume that W[r] consists of  
>> objects[r] distributed in space[r].

> I assume you believe that there must be such a  
> thing as space[i]. If (1) the spatial  
> distribution of entities[i] correspond to the  
> distribution of entities[r] in brain[r], and  
> (2) the spatial distribution of entities[r]  
> in brain[r] enable effective control of adaptive  
> action in W[r], doesn't this imply that there  
> *is* such a thing as space[r]. If not, why not?

Well, rather than once again point to Kant (or to try to paraphrase and compress his arguments), I will try to provide a different demonstration of why I think the ideas of "space[i]" and "space[r]" are problematic and unnecessary.

First, and because I *do* believe there is an observer-independent world W[r], I accept that entities[r] and processes[r] will - in theory - have some form of distribution[r] in terms of the number of degrees of freedom they need to "carry" their own, intrinsic information content combined with the number of degrees of freedom needed to "carry" the information content inherent in their interactions[r] with other entities[r].

At the same time, however, I firmly believe that is as far as any of us can go - even in theory - in seeking to press up against the boundary between what we are capable of knowing and what Thomas Nagel has called, "the view from nowhere" (Nagel 1986).

Specifically, the argument that you can assume there is such a thing as space[i] and then backtrack to a space[r] presupposes that space[i] can contain in the "form[i]" of a distribution[i] of entities[i] the "form[r]" of a distribution[r] of entities [r]. The problem with that presupposition is that the concept of "space[i]" has intrinsic to it the concept of a "point of view[i]", and I cannot accept that there is such a thing as a "point of view[r]".

To put it another way, I cannot see how any entity[r] - for example any rock[r] - can "know" how it is positioned in some supposed "space[r]". All it can "know" is its intrinsic information content combined with its interactions with other entities[r]. Thus, I do not think it can be assumed there is a "point of view[r]" "out there" through which some absolute set of relations between all entities[r] can be made to cohere. (And, for what it is worth, I do not think the general theory of relativity points that way either.)

The question then left is: What does the distribution[i] of entities[i] that you perceive, talk about, measure in common with other people, and base actions upon *mean* if there is no such thing as "space[r]"?

I think the answer is that it is some form of reflection of the number of degrees of freedom - and of the *potential magnitudes of variables along those degrees of freedom* - present in the sensory[r] information[r] (which I have previously called "s" (Hammer 2-Jan)) processed by brain[r] and D[r] to generate conscious perception of B[i] in W[i].

As to how the spatial distribution[i] of entities[i] perceived by an individual can help them succeed with sensory-motor coordination, all I believe we can assume is that the spatial distribution we perceive helps provide us with *part* of what amounts to enough information about the state of affairs in W[r] to allow such coordination to succeed. I do not believe it provides us with enough information to demonstrate that such a thing as space[r] exists.

References:

Treuhub, A. (1991). *The Cognitive Brain* MIT Press.

Nagel, T. (1986). *The View from Nowhere*  
Oxford Univ. Press.

Roland Cook (4-Jan) asked:

- > What does "physical" signify, e.g. as used
- > by Hammer?

An important implicit aspect of my recent posts has been to try to show that the term "physical" is not as simple as it seems, and that for the term "physical" properly to be understood it needs to be analysed using an appropriate notation along with a carefully considered account of how sensory information[r] is likely to arise and be transformed by a B[r]'s brain[r] in the course its experiencing conscious awareness of being in a "physical" environment.

In my account *three* "physical" "levels" (for want of a better word) enter into consideration.

The first level is the noumenal world, W[r], defined at points (2-2a) in Hammer 27-Dec:

- > W[r] will be the world underlying appearances
- > but not including appearances. Thus W[r] will be
- > where information capable of sensory perception
- > comes from, regardless of whether there are observers
- > present to perceive that information.

There is only one W[r] containing all people[r], i.e. all B[r], and all other things[r] able to be perceived as things[i]. (This level corresponds to what McKenzie (15-Dec) called the "dark world".)

The second level is the world image, W[i], defined at points (4-4a) in Hammer 27-Dec:

- > A person's conscious experience of themselves as
- > they act in the world will be generated by
- > processes[r] in their brain[r] which inter alia
- > use real-time sensory input flowing from W[r]
- > into B[r]. Their brain[r] must use that sensory
- > input to generate, for its internal purposes -
- > including conscious sensory perception, and
- > the conscious planning and execution of physical
- > acts - a dynamic *real-time* representation of
- > B[r] in W[r] which can be called B[i] in W[i].
- > Call W[i] the "world image" and B[i] the "body
- > image".
  
- > Your B[i] will be your body as you consciously
- > perceive it, and W[i] will be the world you
- > perceive as containing your body and all other
- > physical things. Thus *importantly* (your) W[i]
- > will be what you refer to as "the physical world".

Each conscious person, i.e. each B[r], will experience their own unique B[i] in W[i]. (This level corresponds to what McKenzie (15-Dec) called the "Perceived World".)



The third, and most abstracted level, is not really worthy of a designator, but for the sake of discussion let's call it W[z].<sup>12</sup> W[z] was implicit in points (8-8c) of Hammer 1-Jan:

- > When people, including scientists, refer to the
- > "physical world", what we are referring to is
- > that which we collectively agree to be the
- > contents of our respective W[i]s.
  
- > We reach agreement on the contents of our respective
- > W[i]s by use of language and, for quantitative
- > purposes, by use of agreed measuring procedures.
  
- > .....
  
- > Thus, through collective agreement, we form a
- > view of ourselves as inhabiting *a single, shared*
- > *physical environment*. In other words, whomever
- > you are, you believe that the physical world you
- > experience - your W[i] - is one and the same, by
- > agreed measuring procedures and by all perceived
- > contents, as the physical world which all others
- > experience (i.e. *their* respective W[i]s).

So W[z] is the "physical world" as it is "collectively acknowledged". Thus, in its highest (most sophisticated and integrated form) W[z] is the physical world as it is articulated in the literature of the physical and biological sciences. (This level corresponds to what McKenzie (15-Dec) called the "Group World".)<sup>13</sup>

Roland's core question was:

- > "Is consciousness physical?"

In my view all of the information, information processing, and information processing structures needed for the genesis of consciousness will exist at the level of W[r]. In other words, consciousness will be created by flows of information[r], by information processing[r] and through information processing structures[r], probably largely occurring within individual brain[r]s. So the answer to Roland's question, at least from my perspective, is that consciousness *is* physical insofar as I would maintain that consciousness is generated entirely by processes[r] taking place in W[r].

But there are some further important points to be made in this area. To begin with, in the arrangement I have proposed, nobody can have *direct* conscious access to flows of information[r], information processing[r], information processing structures[r] or other noumenal entities[r] in W[r].

Indeed, any explanation of the "physical" basis for the genesis of consciousness can only be achieved in the form of articulation at the level of W[z].

In terms of neurophysiological study, what that means is that each individual scientist studying brain information processing will be studying information processing[i] in brains[i] which she/he will have access to only in the form of the contents[i] of her/his (the scientists') respective W[i].

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<sup>12</sup> In the archive this is designated W[s], but the notation is changed here to W[z] for consistency with later work.

<sup>13</sup> A detailed description and defence of the conceptual framework proposed here – which deconstructs what we call “the physical world” into the three distinct ‘levels’, W[r], W[i] and W[z] – is provided at [https://teleodyne.com/deconstructing\\_the\\_physical\\_world.pdf](https://teleodyne.com/deconstructing_the_physical_world.pdf).

Then, in comparing and reaching progressive agreement on their respective investigative techniques[i], and respective findings[i], those scientists will build up a body of knowledge which will form the agreed corpus of brain-relevant knowledge in W[z].

A key question then arising is whether it will be possible to build a theory based on agreed reasoning techniques and W[z]-level agreed observations which can explain *what it is like* to feel oneself to be conscious and to have subjective experience of the contents of one's consciousness.

Such a theory ought to entail an explanation of how qualia arise, and indeed, how all of what is *subjectively* experienced as "physical" can arise. In other words, the theory ought to be able to tell you how your brain can pull off the trick of making you feel and experience what it feels like to be you from the "inside". (i.e. the theory should solve David Chalmers's "hard problem".)

Bearing that in mind, I would make the general assertion, *at the level of possible structures of theories of consciousness*, that if it is decided the ideas in my 27-Dec and 2-Jan posts can be discarded, and that the different layers of what I have meant by "physical" can be collapsed by:

- a) setting W[r] at objective identity to any W[i] (i.e. saying that the idea of W[i] is irrelevant)

and thereby saying

- b) W[z] is an agreed description based on direct observation of W[r]

or by assuming that

- c) W[z] and W[r] are the same thing (an assumption McKenzie 15-Dec identifies as a common source of confusion)

then it will *not be possible* to derive out of those theories how there can be subjective experience such that there is such a thing as what it feels like to be you from the inside.

The reason subjective experience will not be able to be derived using such "collapsed" theories is that the possibility of explaining the reality of conscious, *subjective* experience of the self as a "physical" being in a "physical" world will be eliminated once the idea of a *subjective level*, B[i] in W[i], is itself eliminated.

In practical terms, lack of the B[i] in W[i] level in a theory of consciousness will mean the theory would lack any "place" for information states and flows, and information processing systems understood empirically at the level of W[z] (brain states and structures), to be "translated onto" to form a predicted series of subjective experiences.

Thus, scientists could conceivably learn all of the information processing pathways and activities taking place in a typical human brain, (and even learn *empirically* what types of neural activity "caused" what types of subjective states), but still be unable to arrive at a *theory* of how the whole empirical, neurological ensemble gets operationally "translated" into a personal, self-centred subjective experience of the world, including experience of "physical" and "mental" events (as those terms were used in Hammer 2-Jan).<sup>14</sup>

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<sup>14</sup> A similar position is described and explained (see in particular pp 211) in Fingelkurts, A.A. et al. (2010) Natural World Physical, Brain Operational, and Mind Phenomenal Space-Time *Physics of Life Reviews* 7 195-249.

These points are relevant to arguments presented in David Chalmers's "Facing Up to the Problem of Consciousness". In my humble opinion Chalmers gets everything right until the final pages of the paper, where he concludes information must have a double aspect. I believe he is forced to reach that unusual conclusion because he works from what has been described above as a "collapsed" idea of the physical.

That is to say, without a theoretical framework able to anticipate genesis of a subjective level from brain[r] processing[r] of sensory information[r] and non-sensory information[r] (i.e. without a framework bearing some resemblance to that described by Hammer 27-Dec and 2-Jan), Chalmers must resort to the unsatisfying notion that genesis of subjective experience has to arise spontaneously as a simple property of information itself. (A notion which essentially is a way of giving up on the idea that a *mechanism* can be found to explain how information and its processing at the "physical" level of the brain can operationally be translated into a subjective level made of contents of conscious experience.)

For what it is worth, I am personally convinced that if the foundations of a theory of consciousness are built out of the basis broadly described in my posts of 27-Dec-97 and 2-Jan - that is, with incorporation of a "level" where subjective experience of the self as a physical being in a physical world (B[i] in W[i]) is accommodated within a coherent theoretical framework *that nevertheless is materialist* (i.e. that incorporates a W[r] level) - then the need to invoke an ad hoc double aspect theory of information will be obviated. Instead, the unique information property which will make subjective conscious experience possible will not be that information can have a double aspect (which is simply a new dualism), but will be that information is the only thing which can be *about itself*.

Thus, I think it likely that a clearer understanding of the potential for information and information processing systems to be *dynamically self-referential* is what eventually will allow the hard problem to be solved. In that connection, note that B[i], as described in Hammer 27-Dec, is cast as a dynamic self-referential element in B[r].

#### References:

Chalmers, D. J. "Facing Up to the Problem of Consciousness", JCS 2 (3), 1995 pp. 200-219.

Roland Cook (26-Jan) and Alfredo Pereira (26-Jan) each raised questions about my post of 24-Jan.

With respect to Roland's comments, and in particular his assertion that:

- > Your conclusion is that this solves the hard
- > problem....

my response is that I did not attempt in my post to provide a solution to the hard problem.

Nor, in fact, did I attempt to present a complete, reasoned case in support of the assertions made in the second half of the post, i.e. the half of the post beginning:

- > But there are some further important points to be
- > made....

After completing the first half of the post, which was an explanation of what I had meant by "physical" in earlier posts (and which in direct response to a previous question of Roland's (26-Jan)) I decided the post would be boring unless I added some more material. So, essentially, I decided to fly a few kites.

I would nevertheless stand by my points about what *type* of theory might or might not solve the hard problem (though those points do not, of course, in their own right constitute a solution to the hard problem or, indeed, anything more than a series of structured intuitions.)

Past that set of points, beginning with the passage

- > For what it is worth, I am personally convinced....

I express raw opinions. My objective was to appeal to people's intuition and to see what emerged in response.

Finally, I overlooked the potential for ambiguity in the following:

- > Instead, the unique information property which
- > will make subjective conscious experience possible
- > will not be that information can have a double
- > aspect (which is simply a new dualism), but will be
- > that information is the only thing which can be *about*
- > *itself*.

- > Thus, I think it likely that a clearer understanding of
- > the potential for information and information processing
- > systems to be *dynamically self-referential* is what
- > eventually will allow the hard problem to be solved.

In those passages I was speaking of information in direct reference to the "notion of information" as described in Chalmers' paper, "Facing Up to the Problem of Consciousness" under "The double-aspect theory of information", (i.e. I was speaking in terms of information states embedded in an information space).

If I understand Chalmers correctly, he argues that probable direct isomorphism between a physical process (e.g. a brain state sequence) and a phenomenal process (i.e. a subjective experience coincident with that brain state sequence) indicates that the same “abstract information space” is common both to part of the physical process and at least part of the coincident phenomenal experience.

He then suggests that an “abstract information space” be taken as the ground, and that the best way to look at the relationship between physical processes and their phenomenal partners may be to see the two as different aspects of the same abstract information space. The idea that information has a double aspect is, on that basis, presented as a potential fundamental property of information.

I do think that such a double-aspect approach is another form of dualism, and ultimately is just a fairly clever way of re-expressing the idea – which in itself seems plausible – that phenomenal experience is isomorphic with some of the brain state transformations with which it coincides.

In that respect, what I meant when I spoke of information having the unique property of being able to be “about itself”, was – taking information as a whole, as Chalmers does – simply to say that one information state can, in relation to certain types of information processing systems, be about (can refer to) *another* information state.

For example, a series of information states of the information space of a television screen in Fred’s house can be *about* a series of information states resident in the information space associated with a piece of film of a chariot race run long ago.

Simultaneously, the information states on Joe’s TV screen (he is watching the same station) could be about the same chariot race, as could the information states being captured on Joe’s video cassette recorder (he is recording the chariot race too).

Thus, *taken as a whole*, information has the ability to be about itself, i.e. one piece of information can – in respect of a certain information processing arrangement – be *about* another piece of information.

To draw the key distinction, I did *not* mean, when I said in my last post that information could be about itself, that a *given piece* of information will, in some intrinsic or automatic way, be engendered with being about itself. That would indeed, as Alfredo put it, be a “cute” idea.

So what then did I mean when I said information and information processing systems had the potential to be “dynamically self-referential”? What I was leading into was the idea that certain types of information processing systems could have the ability to sustain dynamic internal information about themselves.

Specifically, I was thinking of an arrangement where information states about B[r] in W[r] – derived from sensory information[r] entering B[r] from W[r] – could be used in an information processor within B[r] to construct a dynamic “map” of B[r] in W[r] feeding into construction of B[i] in W[i]. On that basis my point:

- > ... note that B[i], as described in Hammer 27-Dec, is
- > cast as a dynamic self-referential element in B[r].

was meant to indicate that B[i] in W[i] could be understood to be constructed in relation to a form of dynamic, frequently (ca 10 Hz) updated map of B[r] in W[r], where – in relation to coordinating B[r]’s physical actions – B[i] is very comprehensively “about” B[r]’s situation in W[r]. Thus my point was that since B[i] was within B[r], B[r] would be dynamically self-referential. (i.e. B[r] would be carrying its own frequently updated (dynamic) map of itself around inside itself.)<sup>15</sup>

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<sup>15</sup> This idea of dynamic self-reference – of “the mind as a map keeper that stores the information – coming through the senses in an internal model of self and situation that it uses to steer the body through a complex and changing environment” – has been developed extensively by Jenann Ismael; see pp 201 and more widely in: Ismael, J. *The Situated Self* Oxford University Press, New York, USA 2007.

In conclusion, I did not intend in my last to post to give the impression that I think the claim that B[r] is dynamically self-referential is either equivalent to, or sufficient for, a claim that demonstration of such dynamic self-reference would solve the hard problem. All I said in my last post was that I suspected:

- > that a clearer understanding of the potential for
- > information systems to be *dynamically*
- > *self-referential* is what eventually will allow the
- > hard problem to be solved.

Brendon Hammer  
January 1998

(Footnotes 2020-2023)