

WHAT IS A MIND?

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The Replacement Argument

Imagine that a chunk of your brain was to be replaced by a wire and transistor gadget that, as we shall just stipulate, will keep precisely the same causal relationship with the rest of the brain that the replaced chunk had. We can know, based merely on this stipulation of the sameness of the gadget's effects on the rest of the brain, that you will behave, speak and (in association with the preserved pattern of brain activity) think exactly as you would have done if the circumstances were otherwise the same but no such replacement of a chunk of the brain had been made. For the parts of the brain responsible for behaviour, speech and thought must, according to the stipulation, be affected by the gadget in all ways as they would have been by the normal brain chunk.

But think about this: it would be absurd for us thus to be assured that you would go on behaving, speaking and thinking the same after the replacement if it were possible that your experience might have been different from what it would have been with the chunk of brain unreplaced. If the replacement by wires and transistors in that part of brain activity could have made you see or hear or feel any differently, how could we have the assurance our stipulation must give us that you would not do or say or think anything different? (Anyone who is not startled by this step in the argument is probably not understanding it.) A gadget that saves the pattern of mental functioning must, surprisingly, therein have saved the experience too.

So we can know *a priori* that the preservation of nothing more than that brain chunk's extrinsic causal role within the rest of the mental system also perfectly preserved all the nature of any experience to which that chunk of brain had made a contribution. The radical change of intrinsic properties, from those of the brain chunk to those of the gadget, was necessarily irrelevant to what the experience was like. For only the extrinsic causal role could have shaped the speech and behaviour and other mental functions whose sameness was sufficient to make it absurd that the experience be different. Anything that maintained that role must maintain that contribution to experience, regardless of its intrinsic properties and, I could add, regardless of the presence or absence of any epiphenomena that might have been thought to have depended on those intrinsic properties.

And we can argue that this brain chunk, which was standing for any, is also standing for all the chunks of the brain at once. For, since the replacement of one chunk of the brain by something that maintained its causal role within the mental system kept experience the same, a further such replacement of an additional chunk must also preserve experience, and then, by the same reasoning, any more replacements after that as well. If the whole brain was replaced by gadgets, or anything else, that maintained the same causal pattern, the mind would be unaffected. So, it seems, we have discovered what makes the mind what it is in an ordinary brain: the causal pattern of that brain's parts in relation to each other and behaviour and speech.

This is, I think, an immensely powerful argument for functionalism, and more specifically for that form of functionalism called the causal role identity thesis. But the argument has proceeded too quickly here, and some of what I've said will need some qualification. So let's start again and take things more slowly.

Without stipulation: If replaced, rest of mental activity the same. But this absurd if experience different. Therefore if replaced, experience the same. That conditional claim, thus established, is essence of functionalism.

The Gadget Replacement of the Visual Cortex

I'd like us to begin afresh by thinking carefully about sight. The initial processing of the stimulation of the eyes leads from the eyes to the visual cortex, at the back of the brain. The visual cortex is in turn connected by networks of neurons to parts of the brain that are involved in speech, movement and other functions that are responsive to vision.

The significance of these connections is brought out in a case of aphasia where one set of them breaks down. Someone with a lesion between the visual cortex and the speech-centre that prevents the speech-centre's receiving impulses from the visual cortex cannot speak about what he is seeing. He will either say that he is blind or say that he is seeing something that is actually very different from what is there.¹ The philosophically unsettling thing is that, since the visual cortex is still properly connected to movement and other functions, much of the same person's conscious behaviour apart from speech is based on vision. The same person who sees where to move and how to handle things will honestly say he is seeing something different or not seeing at all. Later we'll discuss the challenge that this strange disagreement of functions poses to our usual thinking about experience. But what concerns us now is that the aphasia case suggests that speech will be informed by vision if and only if a speech centre receives the proper pattern of impulses.

Now we may consider an imaginary case in which the visual cortex has been replaced by a gadget of wires and transistors that is caused by the stimulation of the eyes to send to the speech centre and the rest of the brain exactly the same pattern of impulses as they would have been receiving from the replaced chunk of brain. And, with no more than this, I think we are now in a position to draw a powerful conclusion about the nature of a mind.

We can know that, with our gadget in place, speech and behaviour will be, *must* be, exactly like the speech and behaviour that would have occurred if the visual cortex were there. This is not speculation. It follows immediately from our stipulation of the character of our imaginary gadget. So long as the stipulated gadget is one with the same input/output relationship with the rest of the brain as the replaced visual cortex, all the rest of the brain can do no other than everything it would have done with the normal visual cortex.

The crucially instructive conclusion we may next draw from this is that the visual, and other, experience of the person with the gadget must be exactly the same as it would have been in the normal case. If things looked different or if vision disappeared altogether, surely a person would, or at least might, say "things look different" or "I am blind" and behave accordingly instead of carrying on as though with the normal vision he was not having. If there could have been any change at all in the experience of the person with the

¹ See Norman Geschwind, "Anatomy and the Higher Functions of the Brain", *Boston Studies in the Philosophy of Science* 5 (Dordrecht, Holland: D. Reidel, 1966/68), esp. pp. 354-5.

gadget, if things could have looked different, we could not have the assurance we do have that speech and behaviour would be the same.

Functional Properties

Soon we'll consider more fully whether this result I am claiming, that the gadget preserves experience, is correct. But if it is correct, what does that say about the role of the visual cortex in vision? It will help answer this if we define what I shall call the "functional" property or character of the visual cortex. Among the many properties of the visual cortex, neural, chemical, and computational (and let me also mention the imagined property of generating epiphenomena), there is the functional property of the visual cortex, its purely extrinsic property of causing a particular pattern of effects in the various mental functions. But the visual cortex possesses this extrinsic functional character only because its intrinsic neural and other properties have combined to produce the required pattern of external effects. Let's briefly explore an example of the same kind of relationship of functional and other properties in the workings of the eye.

Retinene is a light-sensitive chemical in the retina of the eye. When this chemical reacts to light it triggers impulses in associated neurons. After a processing of these impulses in the visual cortex, the original retinene reactions are finally translated into effects in the mental functions. In this way the functions are made responsive to the light and the object emitting it.

Now, the functional character of this retinene depends on, but is not equivalent to, its chemical character. Another light-sensitive process that could replace the retinene with no change in the ultimate effects in the mental functions would therein possess the same functional character as the retinene, even though the replacement's non-functional characterization might have been radically different. If the laws of nature were so unaccommodating to such substitution as to have made it impossible for anything but retinene to play its role, it would still have been solely the pattern of effects in the mental functions and not the intrinsic chemical character itself that defined what we are calling the retinene's functional character; and it must be this alone that counted in the character of experience. Similarly, if nothing like our gadget replacement of the visual cortex were in any way possible, we still would have shown, merely by invoking it, that visual experience is logically determined by purely the functional character of the visual cortex, that sameness in the effects of its output is equivalent to sameness in the experience.

Let me take a moment to repeat our important gadget replacement thought experiment in a somewhat more dramatic form. In humans the right half of the visual cortex processes the left side of the visual field while the left half processes the right side. Imagine that one night, without your knowing it, a mad surgeon of remarkable powers replaced only the left half of your visual cortex with a gadget of wires and transistors that would have all the same input/output relationship to the rest of your brain as the removed part.

We can know, given the stipulated character of the gadget, that all the next day you would have been treating things as though they were looking the same on both sides of your visual field. But would they actually be looking the same? Well, there's no reason things seen on the side of your visual field processed by the normal half of the visual cortex should look anything but normal. But what of your experience of the other side, processed by the gadget? Would the part of this page to the left of centre in your vision look normal, while the part to the right looked different because of the enormous difference of intrinsic properties between the gadget and the brain tissue? But just try to imagine that there was a radically abnormal look to anything seen on the right, a look that was different from that of even the same thing when seen on the left, while you just went on thinking, talking and

acting as though things looked the same, and the same as usual, on both sides of your vision. That's absurd. If your experience were affected by the intrinsic difference of the gadget, how could it be that it is impossible you ever say, do or think anything about there being any difference?

Must the Experience Be the Same?

Of course one and the same pattern of speech and behaviour, as described from the outside, might be produced by very different psychological states, as when sincerity is replaced by pretending. It is this consideration that seems to defeat the behaviourist attempt to define the mind purely in terms of behavioural dispositions. But in our case we know that the pattern of psychological responses to vision remains the same; it is impossible that anything like pretending be introduced by the gadget as stipulated. For the parts of the brain that would be involved in pretending, or in any other psychological complication that could have produced the same speech and behaviour despite a difference in the experience, are necessarily unchanged by the gadget and therefore unadjusted to any change in experience. So the speech and behaviour, it seems, must simply be responsive to an unchanged experience.

But there may be a way we can think of even the psychological pattern remaining the same despite important differences in the quality of experience. It seems I can easily imagine myself as experiencing red objects with the same phenomenal quality with which I now experience blue objects and vice versa. And it seems I can also easily imagine myself as having experienced colour differently in this way from birth (which is essentially, of course, the tale often told by philosophers about such a difference of experience between two people). It seems I could further imagine that, despite that private difference in experience, I was still taught to say a fire was "red" and the sky was "blue" and, whichever qualia I regularly experienced with them, I still formed the same patterns of practical, intellectual, emotional and irrational associations and reactions regarding the colours of fire and sky. It seems that the pattern of my psychological responses, not just my behavioural dispositions, could have been the same as now in such an imagined case of qualia inversion, while my experience of red and blue was different. Moreover, it seems I can imagine an automaton, with something like my pattern of mental functioning in its mechanism, but with no qualia, no experience, at all.

But just as it is impossible that anything like pretending be introduced by the gadget, it is impossible also that anything be introduced like the sort of sweeping qualia inversion or absence that might be imagined to allow experience to change while the pattern of mental functioning stayed the same. For, once again, it is impossible for the remainder of the mental system to adjust in any way to any change in the experience processed by the gadget, since the remainder of the mental system is, due to the stipulation, necessarily unchanged.

An inversion that might seem to be without functional implications would have to be both systematic and total; it would have to occur consistently across the whole of the experience involving the relevant qualia, and therefore, in this case, in the qualia of visual memories and imaginings as well as in those of all of immediate vision. (And an absence of qualia that might seem to be without functional implications would have to be a total absence of all the qualia, an absence, that is, of all consciousness.) But our gadget replacement was of only the left half of the visual cortex. So if this replacement somehow resulted in an inversion or absence of qualia in the vision processed by the gadget, this inversion or absence on the right side of vision would clash with the necessarily unchanged qualia of visual memories and associations, as well as with the unchanged qualia of the other side of the visual field. Such a clash would make it absurd, in the now familiar way, that the

pattern of mental functioning could not be reflecting a clash. So qualia inversion or absence cannot be what is happening in the gadget replacement. The experience must simply be the same.

Anyway, even if we did still entertain the idea I have been attacking, that visual qualia are changed by the gadget replacement, we would surely not have expected that this change would be a systematic inversion of the qualia. For in the wires and transistors of the gadget there is nothing resembling a systematic inversion of intrinsic properties of the replaced left visual cortex. We would surely have expected, in the vision processed by the gadget, not a neat inversion but rather a weird new wiry and transistory quality or, perhaps because of the lifelessness of the materials of the gadget, an absence of qualia on that side of vision. Let's examine a bit these very natural thoughts. They take us, I believe, to the heart of the error I am hoping to expose.

It misleadingly seems to us that the intrinsic nature of our quale of red cannot be determined by something as extrinsic to our visual processing as the external pattern of the gadget's causal relations with the surrounding brain. And this seems aptly illustrated by the ease with which one can imagine colour qualia reversing their roles in one's psychology, as we earlier did with red and blue. Impressed by the apparent non-relational immediacy of qualia and their seeming interchangeability, we want to link them intimately to non-relational, interchangeable intrinsic properties of the brain. And we can then seem to understand the possibility of qualia inversion as the possibility of a role reversal in brain activity, between, say, "chemical x" and "chemical y".

But what can prevent our imagining a reversal of the roles of such functionally interchangeable chemicals between the right and left visual cortex of the same person? And then, according to this assignment of qualia to such intrinsic determinations, red and blue things on one side of the visual field would look the other way around from how they looked on the other side; yet they would be treated and thought of, in all the activities of the rest of the brain in which they were compared, as looking the same on both sides. And this would be absurd.

If we are to imagine that qualia can be totally inverted or absent without functional implications, this requires that we think that qualia depend on interchangeable non-functional properties of a sort that *could* thus be inverted or absent without functional implications. But that means it must also be possible that these non-functional properties, and therein qualia, could be changed unsystematically, and that there could be merely partial inversions or absences of qualia, without any functional implications. And this, of course, is absurd.

(Let me just point out here that the anti-functionalist thought experiment of inverted qualia and the pro-functionalist thought experiment of the gadget replacement both require us to be thinking of non-functional properties that can be changed without functional significance. The difference is that the non-functionalist maintains that qualia are dependent on such properties while the functionalist maintains that qualia must be independent of them.)

The gadget replacement swept away the specifically brain-like intrinsic properties. With the gadget there would no longer be anything at all like a chemical x and chemical y in visual processing to account for the difference between the look of red and the look of blue. Yet with the gadget in place you would be treating red and blue and the difference between them just as you usually do; and in fact, as we earlier concluded, it must be that you would still be experiencing them as you usually do. Any attempt to identify mental determinations with such intrinsic determinations of perceptual processing as these chemicals must be misguided.

Let me mention a further couple of closely related considerations against taking qualia to depend like this on internal details of visual processing. We speak about, think about, and otherwise respond to qualia. How would non-relational, interchangeable details of the workings of the visual cortex, such as the presence of chemicals x and y, be communicated in a distinctive fashion across the brain to the speech centre and the areas involved in the other functions?

Our visual cortex emerged from evolution shaped by the requirement that it contribute to the kind of ordered responses to the world that allowed us to survive. Our responses to the world that are based on vision depend on the extrinsic causal character of the visual cortex, on how it affects the rest of the brain. There would have been no evolutionary pressure for neatly differentiating and organizing non-relational, interchangeable chemical or other details of visual processing. If the red and blue qualia within immediate vision, within imagination and within memory all depended on the presence of chemicals x and y, by what hand would these have been distributed appropriately across the relevant brain activities? Evolution would have been blind to all but how we functioned. Any qualia that were determined by non-functional detail would have been overwhelmingly likely to end up anarchic or perhaps undifferentiated rather than ordered as they are in our experience. We would be dealing with the world as though through orderly vision, but the qualia would be in a mess, as clearly they are not. Experience and functioning cannot be put into the merely contingent relationship that these intrinsic properties have to functioning without absurd results. We must rather understand everything of experience including qualia as defined by its relation to the functions of the mind.

But, one might think, there may yet be a way to resist this conclusion. What about the very aphasia case I described earlier? We would naturally regard it as absurd that a person could at once be moving based on vision and honestly reporting he is not seeing that scene in which he is moving. This case of mental inconsistency seems impossible, yet it exists. So maybe what we rejected, a gadget replacement in which experience changed with no effect on mental functioning, is like aphasia, and only seemingly impossible. But the cases are crucially different.

We try to imagine what it's like for the aphasia patient to move around and deal with objects based on vision that he honestly says he's not having. We then realize that the state of vision on which the movement is based and the very different state of vision on which the speech is based must each be experienced as though it did not belong to the same person who is in the other state. But surely both states must really belong equally to the patient. If only one of them had existed, it would undoubtedly have been his experience. How can the mere existence of the other have changed that ownership? The solution to this puzzle, then, is that it must just be *seeming* to the patient that he is in only one of these visual states. He is really in both states at once, but with an illusion in each that he isn't in the other. *Being* in both is not the same as *knowing* that one is. This confusion between metaphysical and merely epistemic boundaries is what makes such a break between the functions of a single person's mind seem impossible though it really is not.²

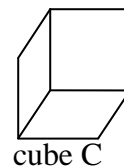
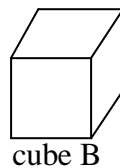
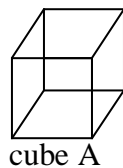
Notice that this case of aphasia, unlike that of the gadget replacement, has functional implications, which are essential to it. It consists in a disharmony between functions, those of speech and movement, which corresponds, we must suppose, to an alienation between the visual experiences on which these functions are based.

² I say much more about this in "One Self: The Logic of Experience", *Inquiry*, vol. XXXIII (1990), pp. 39-68. And in the first and fourth papers in this book.

But while such a break between functions is possible, a break between a function and the experience on which that function is based is a different matter. Honestly reporting that one did not see based on an experience of seeing, or moving about based on seeing when one did not see, really is an impossibility, a contradiction. Both honestly speaking about and behaving towards colours as though they looked the same on both sides of the visual field based on an experience of them as radically different is an impossibility, a contradiction. These are the sorts of genuine impossibilities that made it impossible that our gadget did not preserve experience; for if, as given by our stipulation of the gadget, the same mental functions had to be there, then we could know *a priori* that the same experience had to be there as well. The sameness of function must logically determine the sameness of experience. But how? Let me try to explain.

The Functional Analysis of Experience

Please make yourself alternate between seeing transparent cube A as being orientated



like cube B and like cube C. There should be a dramatic shift in the look of the picture of A as you change from one way of regarding it to the other. How are we to understand your experience in this shift?

A naive view is that the shift is an event in the object, in the picture on the paper, and you are simply open to this in your perception of it. If it were not for the special obviousness in this case of a reason for rejecting it, this naive view would be by far the most natural one. After all, that view agrees with how things look. The phenomenal properties of the picture are changing, and it can only look to us as though the picture in itself is changing.

What makes it so obvious in this case that the natural view is wrong is that you are controlling the shift. Which way the picture looks is decided by you, not by anything in the object. So you know that what changes is not the object but something in you, your way of seeing it. As philosophers we are lucky here. Since in the struggle for survival either way of seeing such a cube (called a “Necker cube” in perceptual psychology) could be useful, in this special sort of case nature has allowed us not only a rare power over our own perception but with it also a rare opportunity to see beyond our usual naivety. In most cases we simply take our perception as a passive openness to the object, which is thought of as in itself just as we see it. But now we may learn that seeing anything requires an activity in us, of seeing it as something.

The Necker cube can, I think, suggest strongly to us the secret of what this visual experience is. Is it not plausible that the shift in your experience of the cube be nothing but a shift between two systematic patterns of potential psychological and behavioural responses, the responses that you would make if called on to describe the cube, trace its front side, imagine objects resting upon it, etc.? When you are shifting from one way of seeing to the other, and the object is looking as though it is changing in its properties, the various ways you would function regarding that object are shifting. The suggestion is that the change of look in the object is nothing but the shift in the functions, from an appropriateness of function to one orientation of the cube to an appropriateness of it to the other orientation. In that change in the functions, and logically inseparable from it, the look of the object is

changing. The object couldn't now look like that without such a shift in the functions and there couldn't be such a shift in the functions without it now looking like that. The shift in functions and in look are necessary and sufficient conditions of each other. And this that the Necker cube so strongly suggests is that which our consideration of the gadget replacement had already proved. Experience is logically determined by function.

Someone who straightforwardly saw an object would be therein fixed to say, do and think things appropriate to it having a look; that would be its having that look for him. A lesion between the visual cortex and the speech centre could, in robbing him of some but not all of that appropriateness of function, make us say he both does and does not see. Further such lesions, between the visual cortex and more functions, would rob him of more ways in which he was seeing till finally, cut off from having any functional character, the visual cortex would have lost its significance for vision and he would be straightforwardly sightless.

The appropriateness of potential responses to an orientation of the cube would not be a consciousness of the potential responses themselves. No, rather the existence of the pattern of potential responses would be the consciousness of the orientation of the cube. And one mustn't imagine lots of distinct structures and determinations in the brain, each designed to deal explicitly with another circumstance in which another appropriate response would be implied by the existence of the mental state. Thus if an appropriate response is that I would, with the right motivation, describe cube A as seeming to have the orientation of cube B, one mustn't expect the function of speech to include an explicit, spelled-out determination that I would be so describing it to a circus clown named Bozo to whom I was honestly reporting my experience or that I would be ready to say the appropriate thing in some particular ancient lost language if I had learned to speak it. These implications would be there, in my function of speech, if it was fixed in a way appropriate to my seeing that orientation of the cube; but they would be there only implicitly.

Let's now examine more closely what happens when we see. Light from the object strikes the retinas. In the retinas light-sensitive chemical reactions trigger an immediate pattern of impulses in associated neurons. Specialized cells are so connected with this immediate stimulation that they are stimulated only by various abstract features of it. For example, one specialized neuron will receive impulses when, and only when, lines lie at a certain angle, no matter where on the retinas they are registered. This will finally be translated into functional responses to that angle of line as an abstraction. Much of the processing in the visual cortex carries on like this, with more and more general features of the scene being registered in specialized neurons. But none of this is vision if it is considered only at this stage. None of it ever would be vision if it did not issue in functional effects that fixed the look of the object of vision by their appropriateness to its being that way.

A pawn in a game of chess may be a piece of stone or a piece of wood. Its being stone or wood is an intrinsic property not importantly related to its being a pawn. That the piece of stone or wood is also a pawn is logically determined by its extrinsic property of possessing a role in a game. Without the context of the game it makes no sense to call this a pawn. Yet the pawn still is the piece of wood or stone. It has intrinsic properties too, intrinsic properties which must be consistent with its role if it is to be a pawn. It would be a crude mistake to want to identify the pawn somehow with the wider game and not the piece of stone or wood simply because it is the wider game that makes the stone or wood also a pawn.

Seeing the angle of a line is something caused by the relevant stimulation of the eyes, something that in its turn then causes the various appropriate functional determinations of talking, thinking and behaving, the ones that go with the line being seen as at that angle. I do not want to say that seeing the angle is the determinations of the functions any more than

I would want to say that a pawn is a game of chess. It is the stimulation of the specialized cell in the visual cortex that is the seeing of the angle, but only because of its effects in the functions. Without those effects the seeing would be bereft of its phenomenal character, as well as its behavioural and internal psychological implications, and then it would be no seeing. I am here endorsing a view called “the causal role identity thesis”; I am endorsing it, that is, if it includes my understanding of phenomenology. A mental item has its mental nature purely through playing the causal role of that item; but its playing that role, I would insist, is to be understood, as we proved through our gadget replacement case, to be fixing any phenomenal character the mental item may have. This is crucial because a phenomenal character is essential to much of the mental. What would a pain be without it?

And, speaking of pain, let me reinforce this analysis of vision with a consideration of another mental item, a pain in my right hand. The naive view that is directly suggested by the way the thing seems is that an unpleasant substance or quality is actually occupying an area of my physical hand, just as some injected material would be doing. But no physical investigation of my hand will turn up that substance or quality. Furthermore, someone who had lost an arm could be genuinely encountering an object just like this one, as a phantom limb pain, without the hand even being there.

The naive view is that if the area of the pain then shrinks two causally connected events are occurring. The pain itself is shrinking, and this shrinking of the pain is causing my experience of it to change accordingly. But there are not here two causally connected events. It would be absurd, a contradiction, for the pain to shrink while my experience failed to reflect this. My experience of the pain logically determines the entire existence and nature of the pain itself. This is not to say that the pain as mental object somehow is the experience of it. This also would be absurd. The pain and the experience of it are correlatives. For a purely phenomenal object like a pain, to be is to be perceived. Its whole existence and nature is logically determined by the existence and nature of the experience of it. In a sense only the experience exists, since in its existence alone does the pain exist; but then in that other sense, of course, that it is perceived, the pain does exist. And all its phenomenal properties, of location, intensity, unpleasantness, are determined utterly in the experience of them.

But what makes the experience an experience of just such a pain? Try to think of my feeling that pain in my right hand while I was in all ways fixed to respond to it as a tickle on the sole of my left foot. How could it have the properties of a pain in my right hand then? How could it fail to be instead a sensation of a tickle on the sole of my left foot?

The pain or the tickle, the phenomenal object, exists only in there being an experience of it. This experience is the brain process, or whatever else, that plays the psychological causal role of the experience of the pain or the tickle. And this experience possesses its phenomenological character, and therein the pain or tickle possesses its apparent character, solely through the experience’s functional character, through the way it affects the mental functions that would deal with the pain or the tickle.

Yet much of the mental is partly or wholly unconscious. The conscious mental activities, speech, imagination, voluntary movement and so on, are, as it happens, in the upper part of the brain. They typically are highly integrated with and reflective of each other, though, as we saw in the case of aphasia, they are not necessarily so. When a child learns to use a spoon, at first it is the conscious mind that awkwardly deals with it. As the child practices, however, neurons lower down in the brain are firing sympathetically with the conscious brain activity and also averaging out the mistakes and clumsiness. Such actions, once learned, are far better performed unconsciously. Soon it will not be the conscious mind that deals with the spoon. The conscious mental activities will be free for those things done better by them.

In the view I am urging consciousness is not an occult quality but rather a certain area and style of activity. Consider for a moment some things that lie on the borderline of consciousness. Some detail of your peripheral vision or the sensations in your toes, were you really conscious of these before I mentioned them? That may be hard to say. But they were brought very definitely into consciousness when I did mention them. In your becoming more conscious of the toes they became much more influential in the conscious mental activities; you then were ready to talk about them, think about them, perform voluntary actions in response to them. My view, of course, is that this much fuller occupation of your conscious functions with the state of your toes just was your more definite consciousness of them.

Further Gadget Replacements

Anyway, this is the sort of understanding of experience consistent with the logical dependence of experience on function discovered in contemplating a gadget replacement of part or all of the visual cortex. And if we now simply followed that successful replacement of the visual cortex with similar replacements of additional chunks of brain, one might have supposed that we would continue to find that experience could not have been changed after any such replacement. Finally, could not the whole brain be imagined as replaced with no possibility of a loss to the original mind?

But it's not that simple. With the visual cortex all that turned out to matter was the sameness of its ultimate effect on the functions. Soon I shall be stressing just how little of the normal visual cortex that required. But when our additional imagined replacements are in the areas of the brain associated with the mental functions themselves, we do not want to end up inadvertently replacing them by other functions that combine to yield the same effects or even with no proper functions at all, if the effects may be maintained without them. To preserve the original functions, and therein the experience, we must, in our replacements, be respectful of the character and the boundaries of the functions.

I believe it will help our thinking about the meaning of gadget replacements in the rest of the brain if we first deal with that business I mentioned of just how little of the visual cortex is required for experience. We should consider a case of the replacement of the visual cortex by a gadget that feeds merely random impulses into the rest of the brain. This could be just a shell with energy randomly playing on its surface and flowing into the surrounding nerves. It may seem that the result for the state of the functions in this case would be chaotic. But let's also imagine that this substitution has been tried in countless different cases, and we are now attending to a case in which the pattern in the rest of the brain ended up accidentally precisely as the normal visual cortex would have produced it. We may not want to say that the subject is properly seeing an object, since the connection between his visual experience and the object is not reliable. But surely the visual experience must still be phenomenologically the same as it would have been with the reliable gadget or the visual cortex. The subject would speak and do the same; so it must all be seeming the same to him.

Could the experience be continued if there were replacements of other parts of the brain by other such accidentally successful shells? First let's take this random gadget case to an extreme. Imagine that the whole brain is replaced by a shell that uselessly receives impulses from nerves that had previously led into the brain and also randomly stimulates the nerves that had led out of the brain. The resulting movement of the body will both seem and be mindless. But we are interested in just one among countless such experiments, one in

which the external forms of the speech and behaviour of a normal person were perfectly, accidentally, matched. Would there be a mind there?

I remarked earlier that behaviourism failed in its attempt to define mental states purely in terms of behavioural dispositions because the same pattern of behaviour, as described from the outside, might have been produced by very different psychological states, as when sincerity is replaced by pretending. Any set of behavioural dispositions, no matter how complex and precisely specified, will be consistent with virtually unlimited numbers of psychological states in which beliefs, perceptions, and motives have been so adjusted to each other that they would be producing such behaviour. Not to mention all the logically possible cases of random neural firings or random gadgets that forever, accidentally, would remain consistent with the given set of dispositions. The point is not whether these states are at all likely. That more than one of them would be logically consistent with that same set of dispositions is what destroys the behaviourist attempt actually to define logically any one of the psychological states, or any mental item in one, by way of such dispositions alone. Any set of dispositions must logically underdetermine the psychological state that accounts for it.

I think our shell-brained creature, despite its impressive pattern of external movements and sounds, precisely those of a proper person, would have no psychological state at all. The operation of this thing involves no mental functioning. With no functions there is no experience, no mind, only show. Even unconscious mental states could only seem to be there. For it has no unconscious functioning; and, besides, something that is never capable of consciousness cannot have a mind and therefore cannot have desires or beliefs, even ones that are unconscious.

Let's next consider the replacement by a shell of just one hemisphere of the brain. This, I think, would be like a case of aphasia. In the remaining normal hemisphere there would be mistaken impressions of normality in the whole, while in the shell there would really be no functions and no experience. It is vital to remember that the absence of the half of the visual cortex that belonged to the shell-replaced hemisphere is not going to result in a missing side of the visual field for the remaining functions. As we have established repeatedly, the visual field exists through the functions, not in the immediate visual processing. The remaining functions will be equally responsive to both sides of vision, since the pattern that is caused in them by the shell is the same as would have been caused by the replaced hemisphere. In our earlier case of aphasia the function of speech was blind while the functions of movement were visual: in this case a hemisphere's functions are gone altogether while the functions of the remaining hemisphere are responsive to the whole of the visual field.

Finally let's think of a neat shell replacement of a complete function, for example some aspect of movement. If what I said earlier about the Necker cube, and the gadget, is correct, then how one is ready to move in relation to an object is part, along with the other visual functions, of what determines how the object looks. Since the shell would, even though accidentally, be fixing that the person move in ways appropriate to the object as seen in the normal case, perhaps this would be sufficient for the same experience to be occurring in this case too. Or is this a bit of a shell game? Do we think there is experience in this shell when nothing of experience is there? Is this another case like aphasia, as was the recent hemispheric shell replacement, with an illusion of complete normality in the other, proper functions but no real experience in what is only a shell of a function?

Let's try to think a little more deeply about how the look of the Necker cube was logically determined by the ways we would respond to it. When I am looking at the cube, there is an enormously complex set of forces, of tensions, in me, that would, in conjunction with those tensions that are my motives, have me talking and behaving in ways appropriate

to one orientation of that cube rather than the other. The point is not at all that I am directly aware of the tensions themselves; I am not. It is rather that in the mere existence of the psychologically pertinent tensions, those that shape my responses, exists my experience of the cube.

The explanation of the existence of these tensions would be irrelevant to their phenomenological character. It seems to me therefore that the shell that neatly replaced a function could be properly participating, even though only accidentally, in the set of tensions that is experience. The shell that replaced the whole brain, however, would be doing no more than accidentally matching an external pattern of movements that any number of combinations of such tensions might have produced; but this would be without the tensions, without experience.

But can we understand qualia this way? Could the look of red, like the look of a Necker cube, be plausibly derived from nothing but how I would respond to that look, when in a lifetime's qualia inversion I would have responded in all the same ways, but to my current look of blue?

An alternative might again seem to be to associate or identify qualia with intrinsic brain properties, this time not of the visual cortex, however, but rather of the parts of the brain that embody the functions themselves. But I think we may counter this temptation with a careful new programme of imagined replacements. This must be careful because we must remember the danger of inadvertently introducing the sort of aphasia that occurred when we replaced an entire hemisphere by a shell; when replacing chunks of brain that embody the functions we must care for preserving the nature and boundaries of those functions if we wish to be sure of preserving the experience. But it would seem there is no danger if we imagine the replacement, by a tiny gadget, of only a single neuron among all those involved in some function informed by vision. And any further replacements of individual neurons, no matter how many we may make, could also carry none of that risk of either fusing or losing functions that would be incurred if a replacement straddled the boundaries of functions in the manner of the hemispheric shell.

So we have confidently replaced some neurons by tiny gadgets that maintain the input/output relations of those neurons to the rest of the function they are in and to the brain in general. Let's say this function has me slowing in response to the colour of a warning signal. If something in the experience to which this function is the response, namely the quale of red, is to be understood as dependent on the presence of chemical x in the intrinsic properties of the function, then replacements by tiny gadgets of neurons that contain chemical x will have robbed the experience of that quale, while the function remained unaffected. But this would be the familiar absurdity. Nothing can in this way come between a function and the experience that is its basis. If I am slowing in response to the signal, the quale that has me doing this is there for me.

We can be confident that a replacement by tiny gadgets of all the neurons in the brain could have preserved the mind perfectly, if, as I believe, we can be confident that this replacement could have preserved the nature and boundaries of all the brain's functions. But if we were to worry that even such replacements on the level of neurons might somehow interfere with the functions, that is of no matter to our real thesis. The important point is that we know *a priori* that whatever did preserve the functions would therein preserve the mind. We know, then, what the mind is. Even if, because of natural laws that were strangely unaccommodating to such substitutions, any replacement of the brain would somehow upset its pattern of functioning, this would leave our thesis untouched. If we extend our meaning of "functional property" beyond the earlier *property of affecting a function* to include now also *property of being a function*, we may say that experience is logically determined by only the functional properties of the brain.

Earlier I made a point about how the evolution of the visual cortex would not have organized qualia if qualia depended on its non-functional properties. We can apply this point to the idea of qualia depending on non-functional properties of the functions. If the quale of red, whenever it occurred within the various experiences of speech, movement, imagining and memory depended on the presence of chemical x, by what hand would this have been distributed consistently across all these functions? Evolution would have been blind to all but functional properties, since survival would be hanging on these alone.

In rejecting the non-functional account of qualia we are rejecting two popular views of the mind. One is a physicalism that would simply identify qualia with non-functional physical properties. The other is epiphenomenalism, a form of dualism. The epiphenomenalist balks at identifying a quale with something so obviously unlike it as a physical property of the brain. But he is so impressed by the indications in brain research that the physical character of the brain and its environment is sufficient to explain the physical activities and interactions of the brain, that he describes the qualia, and all mental occurrences, as mere epiphenomena, non-physical epiphenomena, of brain activity, each caused by some particular physical occurrence in the brain but not itself having any causal powers. So instead of identifying a quale with a chemical x he will say that the presence of something like chemical x in the relevant brain activity is the immediate physical cause of an epiphenomenal non-physical experience of that quale. Both the non-functional physicalist and epiphenomenalist must believe that a gadget replacement changes experience, since with it all the non-functional properties would have changed. But we know such a change in experience without a change in function is absurd. If an epiphenomenalist untypically decides to make his mental epiphenomena causally depend instead on functional properties, he is still out of luck, since the sameness of functions could not establish with logical necessity the sameness of experience if experience is a logically contingent effect of the functions. No, the logical impossibility of the change in experience requires the logical determination of experience by function. It requires the truth of functionalism.

The Replacement Argument and Interactionism

But there's a second form of dualism that might seem to have escaped these problems. This is substance dualism, interactionism. The interactionist agrees with the epiphenomenalist that the mental is obviously not physical. But unlike the epiphenomenalist he is not impressed by the indications of brain research that the physical properties of the brain and its environment are sufficient to account for all the physical activities and interactions of the brain. For he thinks the brain's activities are caused in part by an interaction with something that is not physical, the mind. The mind's creativity and will are a non-physical kind of causation. The brain is merely the mind's mechanistic instrument. The brain mechanically processes sensory stimulation; but if there is to be any experience at all, the result of this processing must somehow be apprehended by the immaterial mind, in which all the actual consciousness of perception occurs. In response to this consciousness, the mind may engage in the peculiar, non-mechanistic activities of thought, decision and willing; and the willing can somehow trigger the brain to pass impulses through nerves to muscles that move the body in a way that was willed.

The interactionist might seem to have avoided the absurdity that arises from identifying or associating qualia with non-functional physical properties of the brain. But till we know where he stands on qualia inversion, we cannot say whether he's really escaped the absurdity.

The problem is that we have not yet specified whether this interactionism is a functionalist or a non-functionalist one. Does the immaterial mind have its mental character

because of its functional or its non-functional properties? If the interactionist believes that my quale of red could, with no functional implications, be interchangeable with my quale of blue in a total systematic qualia inversion, then the interactionist is committed also to the absurdity that these qualia could be partially and unsystematically changed with no implications for the functions. That this contingent relationship of functional and non-functional properties occurred within an immaterial substance could make no difference. The problem would be merely reproduced in an exotic medium.

In our gadget replacements we were imagining a physical brain and its mechanical interactions. But the point that it would be absurd for me to be carrying on functionally the same if my experience changed partially and unsystematically, the point against the contingent relationship of qualia and functioning, is independent of this material setting. The claim that if any physical replacement maintained the function it would therein preserve the experience would still be true and relevant if in fact no physical replacement, because no material thing, could actually maintain the function. The argument didn't at all depend on the replacement being physical; it depended only on the replacement maintaining the function. If any non-physical replacement maintained the function, it too would preserve the experience. And if it happened that there could be no replacements within a mental substance (as before we imagined there might be allowed no physical substitution because of unaccommodating natural laws), the point would remain (as before), that the functional properties logically determined the experience.

Of course, the interactionist who is a functionalist must allow that if ever it is shown that the physical brain actually does embody our mental functioning then the physical brain would have completely accounted for the mind. And although as a functionalist he really has avoided the absurdity of identifying or associating qualia with non-functional properties, he has the same problem as any functionalist in explaining the seeming possibility of qualia inversion.

A Functional Analysis of Colour Qualia

So what should a functionalist say about qualia inversion? It is not surprising that colours are experienced as systematically interchangeable on the most obvious level of functioning. For colours serve, quite literally, as mere placeholders in our spatial experience. It must be that one colour could easily appear in the place of another. Yet colours must be distinguishable; something in how we experience them makes red look different from blue. Anyone who embraces functionalism because of the *a priori* reasoning of this paper must say that, since only functional properties determine the experience of qualia, when we imagine an inversion of that experience without any obvious functional change we are actually imagining an inversion of certain subtler functional properties that give the colours their particular looks. But what could these subtler functional properties be?

At one time it was popular to talk about the "red-green paradox", that two people might be experiencing red and green qualia that were inverted between them with no sign of this difference in their speech or behaviour. But philosophers have largely been won over instead to talking about an inversion of the whole spectrum (with which my earlier inversion of red and blue is roughly in line). This is because the qualia of red and green are not in every way interchangeable after all; they are differently related to the qualia of the other colours.

For example, green will be produced by a blending of blue and yellow. This looks right to us. But if your quale of green was replaced by that of red, the unchanged blue and yellow qualia would be rather unconvincing in producing the former red quale instead of the green when they blended. This would look wrong, even if experienced that way from birth.

It was thought that standing the qualia of the rainbow upside down, an inverted spectrum, would preserve the pattern of blending. But this has been challenged. I think the truth is rather that each colour quale is in a unique relationship with all the others. For then we may be able to understand a quale as logically determined by the set, appropriate only to that quale, of one's potential responses to its potential blendings and contrasts.

There is a feature of colour experience that perceptual psychologists call "colour constancy". I once looked at my familiar brown briefcase lying on a couch and was surprised to discover that a spot on its surface had turned pink. My first thought was that perhaps some strong bleach had been splashed on it. But after a while I realized that a circle of bright, unusually focused sunlight was shining on the briefcase through a small opening in a curtain across the room. As soon as I recognized this fact the colour constancy in my perception changed the look of the colour of that spot from pink-in-the-shade to a lighted-up brown. I was able then to make myself move back and forth between seeing one colour and the other, just as you were able to do between the two orientations of the Necker cube.

I think that when my experience of that colour changed what was crucially changing was a set of implicit potential responses to relationships of colours and light, to how this colour would blend and contrast with others, in sunlight or out of sunlight. To see this colour as pink-in-the-shade was to be ready, implicitly, with all those responses appropriate to its looking pink-in-the-shade; and the change to seeing the colour as lighted-up brown was a change to an alternative state of readiness and appropriateness that was dramatically different. If a colour has any look for us we must be in a state of appropriate response to that look. And the *a priori* assurance that functions preserve all experience requires that the colour having its look just is our being in such a functional state.

The functions of speech and behaviour that we are tempted to think would remain unaffected in a systematic qualia inversion are those based on extrinsic relationships of qualia, such as being associated with certain names or objects. The functions that I am arguing logically determine the qualia, are based rather on qualitative relationships that are inherent in the qualia and inseparable from their natures.

The number nine has extrinsic relationships with its name and with the planets of the solar system, which happen to be nine in number but might not have been. But its inherent relation to three, considered as its square root, logically determines that the number is nine. Nothing that has nine's relationships with three, or with five hundred and four, could fail to be nine. Just so, nothing could fail to be a certain quale that had its inherent relationships with the other qualia. And an expression of those same inherent relationships in the higher functions, in the implicit potential responses to the look of a colour, could not fail to be an experience of that quale.

But the main point for me is not that such an account of our experience of qualia is in its own right persuasive. It's rather that something like this account must be correct because functionalism can be established as necessarily true by the reasoning of our replacement argument.

I confess that the combination of the replacement argument for functionalism and the inverted spectrum argument against it has sometimes appeared to me to represent an unresolvable paradox at the heart of the mind-body problem. On the one hand it seemed easy to conceive of total systematic inversions or absences of qualia that were functionally irrelevant. On the other hand the proposition that such functionally irrelevant changes in qualia were possible would have had to imply that the qualia depended on non-functional properties; and this in turn would have had to imply that there could also be partial, unsystematic changes in qualia that were functionally irrelevant. We have seen that such non-functional disturbances of experience would be absurd. They would be far more clearly

absurd, I have been arguing, than the determination of qualia by purely functional properties.³

If I find myself insisting that my experience of red is uncapturable by any functional analysis, I can stop myself by reflecting that if God were playing a trick on me, of fiddling with the character of whatever was causing me to speak, as long as God preserved just its functional implications for speech, I would go on talking in exactly this way about the absurdity of functionalism. Until, of course, this reflection stopped me. Functionalism seems to me by far the lesser of two apparent absurdities.

One Last Replacement Story

At the relatively unimportant risk of seeming repetitious, I would like to end by telling again a replacement story, though this time in a way that may summarize the debate in a manner not earlier possible.

Imagine that I am frozen soon after my death and that after many decades I am finally thawed and revived. The doctors explain to me that, though I was in good shape otherwise, they decided to replace the damaged left visual cortex (where my fatal injury occurred) with a device that would maintain the normal relationship of inputs and outputs with the rest of my brain. I begin to express fears that this will affect the character of the relevant half of my visual field; but then they explain further that the replacement has been carried out already. Well, I can detect nothing unusual about my vision. So I exclaim how pleased I am that, despite the replacement, my vision has the same old character it always had on both sides of my field of vision; and I thank them very much.

What I have told, of course, is a functionalist story. Only functionalism could allow, not to mention require, experience to go unaffected by a replacement of the left visual cortex that preserved all and only its functional properties and none of its non-functional ones.

³ In his well-known paper "Functionalism and Qualia", which can be found in his book *Identity, Cause and Mind* (Cambridge: Cambridge University Press, 1984), pp. 184-206, Sydney Shoemaker commits the odd mistake of treating the possibilities of qualia absence and qualia inversion unevenly. He rejects the possibility of there being an absence of qualia without functional implications because he considers only a case of partial absence, in which there being no functional implications is, indeed, absurd (as he strangely does not notice would be true also of a partial inversion); and then he accepts the possibility of there being an inversion of qualia without functional implications because he considers only a case of total inversion, in which there being no functional implications is, indeed, plausible (as he strangely does not notice would be true also of a total absence).

His conclusion based on this arbitrary selectivity is that the presence of qualia can be functionally defined, since he thinks absence without functional implications is absurd, but the rigidly predicated character of the qualia cannot be functionally defined, since he thinks inversion without functional implications is possible. I think that his conclusion if he had treated absence and inversion even-handedly would have been the same as mine, that while both absence and inversion of qualia without functional implications seem possible, such a possibility would require that qualia depended on non-functional properties, those that could be absent or systematically inverted while the functional properties stayed the same. And this in turn must require that there be possible partial absences and partial inversions, systematic or haphazard, of such properties, and therein of qualia, without functional implications, which is clearly absurd. The only way of avoiding that clear absurdity is to accept functionalism as the full account of not just the presence but also the character of qualia.

It is essential to an understanding of this whole debate to be clear that a proper sceptic about functionalism would not be concerned about whether it was possible to make such a replacement. In his own stories of inverted or absent qualia such replacements are made; non-functional properties are changed systematically with no functional effect. The debate is entirely about what is logically establishable about the mental *if* such a change is imagined.

For both views are concerned with conditionals. Functionalism can be expressed as the conditional statement, “*if and only if* the functional properties of a mind are preserved, its mental character is preserved”. Scepticism about functionalism can be expressed as, “*if* there is a preservation of functional properties with a change of the non-functional ones, we are not logically forced to think that the mental character has not been changed”. What any sceptic about functionalism needs to show, then, is that we are not forced logically to tell my story in the functionalist fashion.

But there are just two non-functionalist ways to try to reconstruct this story. That neither way is coherent is the doom of non-functionalism.

In one attempted reconstruction, on being revived I am struck by a great difference in the quality of the right side of my visual field and I complain of this. The doctors apologize; they should have listened to the warnings of the sceptics about functionalism. This is the sort of effect on experience the sceptics had feared.

Such a reconstruction of the story is impossible, however. If the gadget replacement about which the sceptics had warned was the one relevant to the issue, the one, that is, that actually did preserve the input and output relationship of the left visual cortex with the rest of the brain, then it would have been impossible for me honestly to complain that my vision was any different from normal. For the pattern of neural activity in my speech centre, and hence the pattern of my speech, must then have remained the same as with the normal brain. So if I complained like this the doctors would need to be apologizing not for having put their faith in functionalism but for having failed to install a true functional equivalent.

But there is one other attempt at a non-functionalist reconstruction of my story to examine. In this one the stipulated effects of the gadget on speech have not been forgotten, as they were in the first non-functionalist attempt, so I am revived and say exactly what I did in the functionalist story. I exclaim sincerely how pleased I am that, despite the replacement, my vision has the same old character it always had on both sides of my field of vision; and I thank the doctors very much. But the right side of my vision is actually a mess. The vision is metallic or missing; it is not normal at all. Yet not only do I go on thanking the doctors for their great preservation of my vision, there isn't as much as a possibility that I could honestly do otherwise. And not only in speech but in memory, imagination, and any other faculty dependent on the rest of my brain, there is not a jot of difference from the normal.

Scepticism about functionalism is based on the claim that preserving only the functional character of the parts of the brain that are involved in experience at least might not be sufficient to guarantee the sameness of the mental. It is impossible to make any sense of this claim.⁴

⁴ The closest thing I know to this paper's replacement argument for functionalism is Gilbert Harman's discussion of the replacement of a pain centre, in his book *Thought* (Princeton, New Jersey: Princeton University Press, 1973), pp. 38-40. The person who most influenced my thinking about the mind-body problem was, indeed, Gilbert Harman. I had wonderful conversations on this topic with him and with Thomas Nagel when they supervised me in my graduate studies. (It's a bit tempting to describe what I've arrived at as a blend of Harman's functionalism and Nagel's insistence on fidelity to the subjective character of experience.)

APPENDIX: A NON-INTERACTIONIST ACCOUNT OF THE INDETERMINACY OF SELF-PREDICTION

Imagine that a computer, with a complete description of its own current state and the rules for the development of this state, and shielded from or else informed fully about any future external influences on it, has been given the job of predicting precisely what it will be like in one of its own future states. And imagine this to be a future state whose exact character the computer could calculate only by taking fully into account the precise development of the states leading up to it. Unfortunately, then, one of those states it would have to take fully into account before it could reach the prediction is the predicting state itself, which must, to be a prediction, be only part way along towards the state that it is predicting. So the predicting state would be one of those that would have to be represented before *it*, the very prediction towards which we are supposedly working, can have been arrived at.

Let me try to make more evident the absurdity of this requirement. The prediction couldn't be made until states that follow the predicting state had been calculated, and that couldn't happen till the predicting state itself had been determined. But it, the prediction, couldn't be determined till after those states following it had been calculated. Precise self-prediction of the sort described would always thus require determining the prediction before determining the prediction and always be impossible.

But, leaving prediction aside, there was already a difficulty, of a sort raised by Popper, Ryle and others, in asking at the start that the computer contain a complete description of its own current state, since the state included the description itself. Therefore the description would not only have had to describe itself and its relations with the rest of the state but also that describing of itself and its relations and so on to infinity.

Notice that these are problems only for *self*-prediction and *self*-description. *Another* computer could predict in detail our computer's future states and entertain a detailed description of our computer's current state. But then that other computer would face the same impossibilities when it attempted to predict its own future or describe its own present state. A computer *could*, however, describe with precision its own *past* states and calculate their development, as long as this remained past. And a computer *could* predict its own future and describe its own current state if this is done with a measure of uncertainty and incompleteness. In particular, it must leave out any detailed account of the nature or effects of its own self-description or self-prediction. But this is not due to any exotic metaphysics; another computer, as we have said, could capture everything.

Each of us strongly feels the impossibility of ever knowing fully or with certainty what he is or what he will do. If I try to grasp what I am or will be, something of that which tries to grasp, the grasping itself, must remain outside the grasp. We are inclined to take this epistemic indeterminacy of self-prediction and self-description for a metaphysical indeterminacy of what we are. The resulting illusion is, I believe, an inspiration for both interactionist dualism and our retributive judgments of desert (in which we must misperceive ourselves as impossibly responsible for our own natures).⁵

⁵ A future state of our computer might be available to precise self-prediction if its detailed character would not be differentially dependent on, and therefore calculable only from, the precise character of the predicting state. For example, from a mere indication that the batteries were running down a computer might predict with precision its own future dormant state.