Is the Mind Physical?
Dissecting Conscious Brain Tissue

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Peter B. Lloyd

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1. The Mind-Body Problem

The mind-body problem has remained essentially unchanged since Descartes put it forward in 1641. The problem is: what is the nature of the conscious mind, and how does it relate to the body?

Today, the prevailing view is that the mind is really a physical phenomenon going on inside the brain. I shall call this view **physicalism**. It contrasts with two other broad views: **dualism** which says the mind is irreducibly different from the brain; and **mentalism** which denies the existence of the brain altogether.

I shall describe a hypothetical experiment that could in principle be carried out on a conscious brain. Then I shall consider what result the doctrine of physicalism predicts as the outcome of this experiment. I shall suggest that that outcome is rather implausible and that it throws doubt on physicalism.

The experiment illustrates a basic problem, which Descartes elucidated in his *Meditations*. It is that the brain is extended in space and can therefore be dissected into parts, whereas the mind is not extended in space. The mind thus has a unity that the brain lacks.

2. Where is my mind?

In everyday life, I imagine each element of my mind as residing in the relevant part of my body. Tactile sensations are a good example of what I mean by this: if I were to drop this word-processor on my foot, then I would obviously have a sharp pain in my foot. Other people seem to have roughly the same intuitive idea of where they are in their bodies. Admittedly, there are some differences. For instance, people variously locate their emotions in the chest, the belly, or the head.

In general, therefore, our intuitive idea of the mind's location is that it is interfused with the whole body. But where is the mind really? I mean, where are the physical correlates of mental events? Surely they are in the brain?

Consider injuries and diseases that damage those nerve fibres that normally carry signals from sense organs to the brain. For example, sciatica. This condition sends painful signals up the nerves into the brain. The brain construes the pain in the area of the body where the incoming nerves are rooted. This is because the brain is unaware that these signals originate somewhere along the damaged nerve fibres *en route*. Or, if a limb is lost, the amputee may have painful sensations which feel as if they are in a 'phantom limb'.

Similar tricks can be played by electrically stimulating an incoming nerve: the brain will at once project the sensation onto whichever bodily part it would have expected the signals to have come from.

What this shows us is that the mind is not really dispersed throughout the body but is centralised in the brain. The brain constructs an illusory distribution of mental sensations over the body.

3. Physical Correlates of the Conscious Mind

Using actual experiments on living brains, scientists have found approximately which regions of the brain are involved in which elements of a person's mental life. A vivid means of doing this is **positron emission tomography**. In this technique, radioactive glucose is injected into the bloodstream. Since glucose serves as a fuel for the cells in the human body, it is absorbed more by brain cells that are currently active than by idle ones. Minute particles are emitted by the radioactive glucose and pass straight through the body. They are detected by sensitive electronic devices, whose readings are automatically fed into a digital computer. By carrying out some geometric calculations, the computer works out where in three-dimensional space the radioactive sugar is being used most rapidly. Those are the sites where brain cells are busy. The computer can display, in a diagram, a slice through the brain revealing where the nerve cells are especially active.

Sites of neural activity can now be determined to within a few millimetres. For the sake of argument, however, let us imagine some future scanner that can identify individual cells.

Let us further suppose that, using this scanner, neuro-psychologists can find precisely which brain cells are involved in some simple perception - say, the sensation of my finger being pricked with a needle. Furthermore, let us suppose that they have found the 'essential' brain event of that sensation. I mean, an event such that I feel the prick if and only if that brain event occurs. That event would comprise the firing of some particular network of nerve cells in some particular pattern. Let us call this network of cells the **pricked-finger corpus**. We need make no assumption about how big this body of cells is, but it is almost certainly tiny.

4. Mind-brain Identity Theory

When my finger is pricked, we know that my sensation of pain is associated with something happening in the pricked-finger corpus. But can we say that my sensation literally is the same thing as that physical event? According to a version of physicalism known as the **identity theory**, the answer is yes.

To be sure, not all physicalists are identity theorists. Some supporters of physicalism choose not to equate mental events with brain events, but prefer to equate the mind with a person's overt behaviour or social interactions. Others say that the mind is related to the brain in a more subtle way: that mental events are not simply the same thing as brain events, but that the mind is 'immanent' in, or 'supervenient' on, neural activity. In this article, though, I shall address only the identity theory, which is the most popular and precise form of physicalism.

5. What's wrong with the identity theory?

A basic problem for the identity theory is that although neural activity is spread out in space, the stream of consciousness at any moment is a unity.

The brain comprises nerve cells that are held together in a matrix occupying a volume of space inside the skull. Each cell works locally, in the sense that it responds to electrical forces that impinge upon it, and it communicates by sending out electrical signals that take time to reach other cells. In contrast, all the perceptions that a person is having at one time are connected by virtue of their belonging to a single mind. For example, I can hear someone talk and see her lips move at the same time. Yet the parts of my brain that handle hearing and seeing are separated by several centimetres of grey matter. Therefore, if my mental sensations of sight and sound are just brain events, then they are not connected in my mind at the time of their occurrence. For it takes time for them to connect in any way. So, how can they form a single stream of consciousness and appear to be simultaneous?

The stock answer is that the quickness of the neuron deceives the mind. The brain works so quickly that we do not notice the few milliseconds that it takes to send signals from one part of the brain to another. Thus the passage of information between the hearing and seeing centres of the brain is so fast that it seems to take no time at all.

But that does not really solve the problem. No matter how quickly brain cells send signals, the fact remains that each cell is affected only by physical forces that come into direct contact with it. Neurons do not communicate by action-at-distance. So, if the identity theory is true, and each mental event is a neural event happening somewhere in the brain, then every such event occurs in isolation and is only afterwards admitted into the mind. The snag is that, if sensations are retrospectively joined to a mind, then we can interrupt the joining in ways that are inconsistent with the unity of the mind.

One kind of interruption is to introduce long artificial delays - of minutes rather than milliseconds - between the occurrence of a sensation and its joining the mind. For example, consider the sentence, "A finger-prick sensation occurred in my mind at 1:15 pm". If this is true now, then it must have been true at 1:16 - because the contents of the mind obviously cannot be altered after they have happened. But the identity theory implies that the contents of the mind can indeed be altered retrospectively. For (according to the theory), a perception that occurred at 1:15 will not be incorporated into the mind until a later time. Normally, it will be incorporated a few milliseconds later. But if a delay of quarter of an hour is artificially introduced, then it will not be incorporated until 1:30 pm.

The rest of the article illustrates this paradox with a hypothetical experiment.

Of course, the point is not simply to show that if someone's brain is interfered with, then his perceptions may become scrambled. The point is that the identity theory is inconsistent, but the problem becomes glaringly obvious only when the brain is subject to some such extreme treatment.

6. Consciousness in-vitro

Having found which of my brain cells contain the mental sensation of a finger-prick, a surgeon could cut out those cells and keep them alive in a test tube. She could then stimulate them electrically in such a way as to reproduce, within those cells, precisely the neural activity that had formerly been going on in my intact brain whenever my finger was pricked.

Could we then say that my severed brain tissue felt the sensation of pain? - even though I might be many miles away, or I might have died in a car crash? It seems bizarre that a piece of tissue in a test tube can have mental experiences. Yet this proposition follows from the identity theory. If the perception of the pain is identified with a neural event, then that perception must occur whenever and wherever that neural event does. Whether the neural event happens in a test tube or beneath the cranium is immaterial. (Indeed, for the purposes of our experiment, the surgeon could leave the pricked-finger corpus inside my head but isolate it

from the surrounding tissue by wrapping it in a plastic film, with holes for the electrodes that are to stimulate the corpus.)

The proposition that the severed brain tissue can feel pain may seem less strange if you consider that its perception of pain remains isolated from other mental phenomena. When such a sensation occurs in an intact brain, it evokes memories of similar jabs, and might trigger overt reactions such as a jerk of the hand or a grimace. Therefore, one would be misled if one tried to imagine what it is like to be a piece of severed brain tissue. In an intact brain, each perception quickly casts a penumbra of associated images and thoughts: it is probably impossible to imagine a single sensation *simpliciter* for more than a moment. Nevertheless, in the instant of its occurrence, the tissue's sensation of pain must be identical to the pain as it is felt in a normal brain (if we are to accept the literal truth of the identity theory).

7. Consciousness transplanted

Let us continue with the experiment. The surgeon repeats the operation on someone else's head - removing the pricked-finger corpus. She might then insert the corresponding part of my brain into the hole in the other person's head, and make all the normal connections between my transplanted tissue and the matter that now surrounds it. This other person then has his finger pricked. In whose mind does the sensation now occur - mine or his?

The identity theorist would answer as follows. When the brain portion is excised and kept alive artificially in a test tube, any mental sensations that it experiences do not belong to anyone's mind. And if the tissue is incorporated into some other person's brain, then any sensations that occur in it would belong to the recipient's mind. We can express this reasoning by the following rule: if the pricked-finger corpus causes events (such as a grimace, or just a memory impression) in X's body, then the sensation is said to occur in X's mind.

8. Consciousness in two brains

So far, the identity theorist's view of what is happening is plausible. But let us take the experiment further. Now, the surgeon keeps my pricked-finger corpus alive in a test tube (instead of transplanting it into someone else's head). And she connects its nerve fibres to an electronic micro-processor. This gadget can receive any neural signals produced by the tissue, and transmit two identical copies of the stream of signals along the two cables. It can thus act as a signal duplicator. In addition, it can store the signals for a length of time before forwarding them. On the top of this black box is a dial by which the delay can be set at anything from zero to sixty minutes. When it is set to zero, signals pass straight through the box without being slowed down.

The surgeon now takes a cable that leads into the front of this box, and attaches it to the excised tissue in the test tube. At the back of the device, there are two cables: one cable she connects to my brain and the other cable to the brain of the other person - who underwent the same operation. In each brain, the wires are hooked up to all the normal points of connection that a pricked-finger corpus should have. By flicking a switch on top of the box, the surgeon can set the device to run in one of three modes: to relay the signals produced by the severed tissue to my brain; or to the other man's brain; or to transmit identical copies of the signals simultaneously to both brains.

Having set up her apparatus, the surgeon begins. Using an electrode, she stimulates the nerve cells in the test tube as before. The cells emit their usual electrical signals and these are captured and stored by the black box.

In whose mind will the sensation occur? The identity theorist answers by the rule stated above: if the pricked-finger corpus affects X's body, then the sensation is said to occur in X's mind. While the cells are firing, it is indeterminate in whose mind the pain occurs, or indeed whether it is occurs in anyone's mind. If the outgoing signals are released from the apparatus's store, and switched to my brain, then (according to

the identity theory), I feel the pain. But if they are switched to the other person, he feels the pain. And if switched to both, both feel it. Finally, if the device's memory is erased without having been forwarded to anyone's brain, then nobody feels the pain the pain would have occurred by itself.

9. Can a sensation join a mind after its occurrence?

This conclusion jars with everyday experience. If I prick my finger then any pain I feel is in my mind when it happens. According to the identity theory, the pain sensation does not belong to anyone's mind at the time it occurs. It enters someone's mind only when it causes some further events in that mind. But that is necessarily after the sensation has occurred.

The crux of the difficulty is that the joining of the finger-prick sensation to the mind is retrospective, rather than contemporaneous with the sensation.

We can sharpen the paradox by introducing a delay in the transmission of signals from the test tube to the brain.

Now the surgeon flicks the switch so that only my brain gets the signals from the test tube. And she turns the dial on the black box to thirty seconds, so that the signals are held that long before being forwarded to my brain. What happens when I receive one such burst of signals? According to the identity theorist, the sensation of pain now joins my mind. Yet, that does not mean that I feel the pain at that moment. For, by the identity theory, the sensation had already occurred thirty seconds earlier, in the test tube. What happens physically is unproblematic: the signals that have been emitted by the severed tissue produce a jerk in my arm and a grimace in my face, and perhaps a memory trace of the pain. That memory will record the pain as if it had occurred at the time of receipt of the signals, which was thirty seconds after the pain really occurred.

The identity theorist is obliged to say that the sensation acquires the property of belonging to my mind thirty seconds after its occurrence. Obviously, this contradicts the normal meaning of saying that a sensation is in my mind. If a sensation is in my mind, then it must be so when it occurs, and cannot become so later. Since this absurd conclusion is entailed by the identity theory, we should entertain serious doubts about the theory.

[Aside. We must differentiate between what the identity theorist is claiming here and something that may seem similar but is essentially different. It is, of course, quite possible to acquire a memory impression of a perception that did not take place. Indeed, memory faults of this sort are common. For instance, I might have a memory impression of seeing John Smith at a party last Christmas, although in fact he was not there and it was at a New Year's Eve party that I saw him. False memories may be subjectively as convincing as real ones, but they do not represent real past experiences. In our hypothetical experiment, the identity theorist is not claiming merely that I acquire a memory impression of the pain (which would be philosophically unproblematic). He is making the more fundamental claim that the experience of the pain retrospectively joins my mind. That part of his claim is unacceptable because it contradicts what we normally mean by saying that a sensation occurs in someone's mind.*]*

10. Varying the delay of joining a sensation to a mind

The surgeon still has her apparatus set so that the signals from the test tube are forwarded only to my brain. And the time delay is now shortened to zero, so we are back to normal. (OK, so it will leave a tiny delay, as the signals travel at finite speeds in the wires. But it is too short for anyone to notice it.) We can assume that this situation is indistinguishable from that of the intact brain. Therefore I feel the pain as normal.

Now, the surgeon gradually turns up the dial. She stimulates the severed tissue in the test tube, waits for me to report what I feel (if anything), then increases the time delay by another second and repeats the

stimulation. Would I be able to discern a change in the sensation produced by the device? If so, when? Three possible answers might seem likely.

Maybe I would experience the pain at progressively longer delays after the stimulation? No, because (according to the identity theory) the sensation of pain would always occur at the time of stimulation. It would already have occurred by the time that the delayed signals reach the remainder of my brain.

Or maybe, I would feel a progressively weaker sensation of pain, which would have faded completely from my awareness when the delay had been increased to, say, five seconds? No, because (according to the identity theory) the strength and all other qualities of the sensation remain constant. For, the sensation's qualities are determined only by the constant pattern of discharges in the test tube.

Perhaps I would suddenly stop feeling the sensation when the delay reached, say, five seconds? Not according to the identity theory: for the sensation would still occur in my mind (albeit retrospectively). Nor would there be any diminution of the degree to which the sensation belonged to my mind.

The experiment thus leads to a testable prediction that conflicts with what everyday experience tells us about the nature of our own minds. It therefore suggests that the identity theory is wrong.

11. An electronic analogy

It may help to contrast the brain-surgical experiment described above with a similar experiment on a pocket calculator. According to physicalism, of course, the brain is just a massively complex computer. Certainly, the brain does a lot of computing: in just walking down the street, you need to move your muscles in an intricate way that present-day robots cannot yet emulate. And the brain computes these complex movements easily. Nevertheless, besides processing information, the brain also has a conscious mind - which radically distinguishes it from the pocket calculator, or any other man-made computer.

Using a millivoltmeter, an electronic engineer may find precisely which bits of a calculator's circuit compute 2+2 (which we may call the 'two-plus-two corpus'). Moreover, she may locate the 'essential' electronic activity such that the calculator computes 2+2 if and only if that activity takes place. She now cuts out this section of cicuitry, and keeps it running on a circuit board. Inputs are given to this corpus so that its internal activity is the same as when it was computing 2+2 in the intact calculator. We can say that the calculation of 2+2 is now occurring in the severed section of circuitry on the board.

The electronic engineer can experiment on this detached 'two-plus-two corpus' in just the same way as the surgeon experimented on my pricked-finger corpus. But the results will not be at all paradoxical. A purely physical theory of electronics will suffice to give correct predictions of the outcome.

The crucial difference is that the stream of conscious experiences sustained by a brain are indissolubly interlinked, whereas the computations carried out by a pocket calculator are not. By dissecting a pocket calculator, we can dissect the computations going on inside it. And, indeed, by dissecting a brain, we may dissect its biological computations. But we cannot thereby dissect its conscious mind.

12. Summary

The 'identity theory' is the popular belief that consciousness is just neural activity. Many scientists regard this is as self-evidently obvious. But the theory leads to nonsensical implications when it is applied to hypothetical experiments that involve the dissection of conscious brain tissue. I would conclude that the identity theory is wrong.

In fact, I think the whole physicalist idea is wrong. I think it's obvious that the mind is not physical at all. Unfortunately, I don't have space to argue the point here ...

[Link to unpublished section]