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Parity Cuts Both Ways: Split Brains and Extended Cognition

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RESUMEN

Los detractores de la hipótesis de la cognición extendida creen que los procesos cerebrales son especiales. Planteo una objeción a esta creencia en la importancia de la actividad del cerebro basada en el examen de las investigaciones sobre el llamado 'síndrome de cerebro dividido'. Las personas que no tienen un cuerpo calloso que funcione a veces compensan ese déficit utilizando una técnica llamada '*cross-cueing*', que no es más que hablar o gesticular con uno mismo. Sostengo que, dado que la función de esta parte del cerebro puede ser asumida por canales 'externos', no hay razones para pensar que haya algo significativo en el hecho de que el cerebro lleva a cabo la función.

PALABRAS CLAVE: *cognición extendida, externismo, síndrome de cerebro dividido,* cross-cueing.

ABSTRACT

Opponents of the hypothesis of extended cognition believe that there is something special about brain processes. I challenge this belief in the importance of brain activity by examining some of the research into so-called 'split-brain syndrome'. People who do not have a functioning corpus callosum sometimes compensate by using a technique called 'cross-cueing', which is no more than talking or gesturing to yourself. I argue that since the function of this part of the brain can be taken over by 'external' channels, there is no reason to think that there is any significance to the brain's carrying out the function.

KEYWORDS : *Extended Cognition, Externalism, Split-Brain Syndrome, Cross-Cueing.*

I. INTRODUCTION

In an influential article in *Analysis*, Clark and Chalmers (1998) raise a challenge to the widely accepted assumption that the cognitive processes (partly) constituting an individual's mind take place entirely within his brain (or perhaps, entirely within his head or body). They advance an alternative

view – the hypothesis of extended cognition (HEC) – largely on the strength of a principle – the parity principle (PP) – which is explained and made plausible by means of a case study – the story of Otto and Inga. This chain of reasoning has since received considerable discussion in the literature [Menary (2010); Adams and Aizawa (2008)].

In this article, I offer additional defense of HEC and PP through the examination of a somewhat more complicated case than the story of Otto and Inga. Unlike most other philosophical thought experiments, the situation Clark and Chalmers describe is completely realistic and commonplace: Otto remembers certain information by writing it down in a notebook, while Inga remembers the same information by storing it 'in her head'. What is controversial about this case is the application of PP, permitting an inference to HEC and extending the bounds of cognition. To a first approximation, PP asserts that any process that occurs outside the head (such as Otto's looking up information in his notebook) but performs the same function as a *mental* process occurring inside the head (such as Inga's simply remembering the information) is also a mental process. This application of PP supports HEC, which says that a person's mind may (and usually does) extend beyond his brain and body. Otto's notebook can literally be part of his memory, according to HEC, since the cognitive processes that constitute his mind need not take place entirely within his head.

The case study I offer here involves the so-called 'split-brain syndrome' discovered in the 1960's by Roger Sperry and his colleagues [Sperry (1968)]. This situation is much less commonplace, but just as realistic as the case of Otto and Inga. It also juxtaposes two processes that perform similar cognitive functions but take place through very different media, one by means of a neuronal connection and the other out in the social world of utterances, glances, and gestures. Its purpose is to support HEC by providing an especially hospitable setting for PP. It is my hope that distinctive features of the split-brain case, in particular the *intimacy* of the connections that are implicated and the *ease* with which we all, as it turns out, switch back and forth between the internal and external processes involved, will help convince some who find the two processes that are compared in the case of Otto and Inga too different from one another to establish parity.

In considering HEC and the plausibility of PP, it is especially useful and appropriate for us to narrow our focus from the familiar situation of remembering an address to the esoterics of functional brain anatomy involved in the split-brain syndrome, since it is precisely the significance of brain processes that is at the core of the issue about extending the bounds of cognition. HEC is sometimes formulated in terms of the skull or skin boundaries [Clark and Chalmers (1998), p. 7; Clark (2003), p. 5; Rowlands (2003), pp. 1-2], but its opponents (those who hold that the vehicles of cognition must be internal) do not, in fact, insist that cognition can take place only inside the

skull or *skin*. For one thing, they do not balk at the premise of Daniel Dennett's thought experiment in 'Where Am I?' [Dennett (1978)] in which Dennett's brain is *removed* from his skull but carries on cognizing (and controlling his behaviour).

What vehicle internalists really care about these days is not so much the boundary between the body (skin or skull) and the rest of the world but rather the difference between brain processes and everything else. They believe that brains are magical ('deeply special' [Clark (2003), p. 26]) in a way that notebooks (and gestures and facial expressions) are not. Although the brain is not so magical as (but perhaps it is more literally 'internal' than) the Cartesian soul was, it is the most magical system available in today's scientific culture. It is the internal system that nearly all contemporary vehicle internalists have seized on to host the mind.

So, opposition to HEC is based on the view that there are some things that can be done with a brain that cannot be done with anything else. Some *supporters* of HEC even concede this point for conscious experience, although not for cognizing generally, since, even more than cognition, consciousness seems to require a magical medium [Clark and Chalmers (1998), p. 10].[1] In doing this, they are retracing (unproductively, in my view) some of the same ground covered by Thomas Huxley's variety of soul-based internalism – epiphenomenalism – which conceded cognition to physical (brain) processes only to reserve consciousness exclusively for soul processes.[2] I will confine the discussion in this article mainly to the issue of cognition, avoiding the question of extended consciousness, although some of the authors whose views I discuss in Sections IV and V use the word 'consciousness' (somewhat confusingly) in reference to cognitive processes. I will do my best to sort out these differences of usage as they arise.

II. Split Brains

Cognitive neuroscience is the brain-based approach to the study of mind and cognition. It proceeds by asking 'how the neural wiring of the brain constrains and shapes the information processing capacity of the human mind' [Banich (1995), p. 271). Significant advances in our technical abilities to scan and image the brain, especially over the last twenty years, have given tremendous encouragement and support to research using this approach. This is so, in spite of the fact that there are all sorts of stunningly weird phenomena associated with normal and abnormal variations in brain anatomy, enough to make some people despair of learning anything significant about mentality using a brain-based approach.

Merker (2007), for example, describes the quite impressive competences of some mammals (rats and cats) who have undergone experimental

decortication (removal of a major portion of the brain). He also claims that some human children who were born without a cortex (a condition called 'hydranencephaly') are nevertheless conscious (they smile, laugh, 'fuss') [Counter (2005)]. Such children are sometimes diagnosed as being in a persistently vegetative state simply on the evidence of their brain anatomy, even though their behaviour strongly suggests otherwise. Lewin (1980) relates John Lorber's story of a university student (an honors student in mathematics) who was discovered (in a routine physical exam) to have 'virtually no brain'. 'His cranium is filled mainly with cerebrospinal fluid'. However, cases like these and many others have not dampened the enthusiasm of those pursuing a brain-based approach to the study of cognition, because they know that the brain must play *some* role in thinking.

HEC is the claim that other systems besides the brain may also play a role in cognition. However, the brain seems to be a deeply special thing, as I have remarked, and it is partly the mystery of its operation that generates resistance to HEC. When we consider a commonplace cognitive task, such as remembering an address the way Inga does ('in her head') most of us would be at a loss to try to say how we accomplish this.[3] In contrast, we find it simple to describe how Otto remembers the address.[4] This encourages us to think that what the brain does is very different from what can be done with a notebook and, therefore, genuine thinking (cognition) can take place only in brains. One thing we can do to try to diminish this mystery is to look more closely at what cognitive neuroscience is able to tell us about brain processes.

The cerebral commissures (CC) are bands of hundreds of millions of nerve fibers that connect the two hemispheres of most mammalian brains, including human brains.[5] Surgically severing this connection (cerebral commissurotomy) was, before the development of certain drug therapies, the only really effective treatment for severe epilepsy. This surgery diminished the epileptic seizures seemingly without any side effects. Indeed, before Sperry and his colleagues discovered these side effects (the 'split-brain syndrome'), it was said, as a joke, that the *only* function of CC was to transmit epileptic seizures.[6]

We now know that the function of CC is to communicate information between the two hemispheres of the normal brain. Surprisingly, most of the functioning of CC can be (and often is) smoothly and efficiently replaced by processes that are external to the brain, including utterances, gestures, and eye and head movements. These replacement strategies are so effective that people who have undergone commissurotomy behave quite normally (after a recovery period) in all but the most carefully contrived experimental situations, and people born without a corpus callosum (a condition called 'callosal agenesis') can be reliably identified only by imaging their brains, but not by observing their behaviour, which is, again, normal in everyday situations.

What Sperry discovered was that in certain carefully controlled experimental situations, split-brain patients display a bizarre kind of mental disunity [Gazzaniga (1970)]. When different information is sent to each half-brain (one way this can be done is by exploiting the fact that each half-brain receives information almost entirely from the contralateral visual field) the patient acts on what seems to be a contradictory set of beliefs. For example, when the subject visually fixates on a central spot and the words 'key ring' are quickly flashed on the screen, 'key' is being sent exclusively to the right hemisphere while 'ring' is being sent exclusively to the left. The patient is then asked to report on what he was shown; he will say 'ring', because speech production is normally localized in the left hemisphere and the left hemisphere is aware of 'ring' in the right half of the visual field. But, if he is asked to use his left hand to point to a sample of what was displayed (or to draw a picture of it), he will point to (or draw a picture of) a key. This suggests that the subject both believes that 'key' (and not 'ring') was flashed and believes that 'ring' (and not 'key') was flashed, but does not believe that 'key ring' was flashed. What is happening, it seems obvious, is a breakdown in communication between the two hemispheres. The odd pattern of behaviour is the result of each hemisphere's ability to perceive and believe and act on its own, independently of influence from the other hemisphere.[7]

Split-brain syndrome occurs only in carefully controlled laboratory circumstances, and there are a few reasons for this important fact. The main reason is that it takes some careful contrivance to ensure that the subject doesn't move his eyes during the display and thereby send duplicate information to each hemisphere. In ordinary life, the two hemispheres often do not need to communicate perceptual information over CC, because each independently receives its own virtually complete input directly from the environment. Results from visual simple reaction time (RT) studies indicate that normal brains work more efficiently when each hemisphere uses duplicate information in this way, rather than by sharing or transferring that information over CC or by some other brain route. This may be partly because of the conduction delays that are involved with sending information over CC [Ringo et al. (1994)].

Miller (2007) and his colleagues have recently shown that in normal subjects, both hemispheres are involved in the initiation of key press responses to visual stimuli. RTs are shorter when stimuli are directed to both hemispheres, because unilateral stimulation requires that the signal be transmitted over CC before the other hemisphere can participate in (and help facilitate) movement initiation. In split-brain subjects, response to unilateral stimulation is comparatively slow as well, because the information must pass over much slower sub-cortical routes, since communication over CC is not possible. But RT to bilateral stimuli is short, since, again, each hemisphere can make its own contribution to response initiation. This works because each hemisphere receives and uses its own information from the stimulus

event. As expected, the redundancy gain (the gain in RT from bilateral over unilateral stimulation) is significantly larger in split-brain individuals than it is in normal subjects [Miller (2004)].

Another reason that the split-brain syndrome usually only shows up in laboratory situations is that it seems likely that only certain kinds of information (or perhaps information that is used only for certain kinds of tasks) is normally transmitted over CC. In other words, a proportion of the needs of the disconnected hemispheres to communicate with one another can be served by intact sub-cortical connections between them, not to mention the older and even slower hormonal routes of communication through the shared blood supply. Sergent (1990), duplicating Sperry's experimental situation and isolating the inputs to each hemisphere, demonstrated that while split-brain subjects cannot make 'same or different?' judgments about two numbers presented to different hemispheres, they *can* make 'larger or smaller?' judgments about them.[8] So, it seems that information about the identity or the name of visual stimuli for the (perhaps, more intellectual) purpose of comparison is normally transmitted over CC, but information about size or quantity for the (perhaps, more pragmatic) purpose of integration and action is not.

Finally, the remaining information that is not normally sent over subcortical (or hormonal) connections and has not been duplicated in input must be sent over CC in normal subjects, but this isn't possible for split-brain subjects. Now, they respond to this last remaining difficulty in an ingenious way: by doing something experimenters have come to call 'cross-cueing'. Even in the absence of CC, each hemisphere can send messages to the other hemisphere containing the necessary information by making physical movements with those parts of the body that are under its control. In a case described by Gazzaniga (1967), when a red or green stimulus was presented exclusively to the right hemisphere, the split-brain subject was unable verbally to answer the question 'red or green?' But, with some practice, he was able to say the right answer if permitted to make a second attempt after initially getting the answer wrong. The really odd thing about this correction was that it was not the experimenter who was correcting the subject, rather he was correcting himself! Gazzaniga explains:

> We soon caught on to the strategy the patient used. If a red light was flashed and the patient by chance guessed red, he would stick with that answer. If the flashed light was red, and the patient by chance guessed green, he would frown, shake his head, and then say, 'Oh no, I meant red.' What was happening was that the right hemisphere saw the red light and heard the left hemisphere make the guess 'green.' Knowing that the answer was wrong, the right hemisphere precipitated a frown and a shake of the head, which in turn cued in the left hemisphere to the fact that the answer was wrong and that it had better correct itself [Gazzaniga (1967) quoted in Marks (1981), pp. 47-48].

In another study [Butler and Norrsell (1968) quoted in Bogen (1990), p. 218], Butler and his colleagues asked their subject to say which of three differently shaped wooden objects had been placed in his left hand (out of sight): a sphere, a pyramid, or a cube. At first, he was not able to say which shape it was. After a few trials, though, he started to give the correct answers. Here is how: the right hemisphere would take control of the head and point it towards something in the room with the appropriate shape (a round wall clock, for example, to indicate that the correct answer would be a sphere or a square window to indicate that it was a cube). The left hemisphere was then able to catch this cue and make a correct verbal response. The researchers eventually caught on to this and when the subject was blindfolded, his answers fell back to chance levels of correctness again.

III. PARITY

The scientific and philosophical community has found these and other aspects of split-brain syndrome fascinating, while offering, in many cases, exactly the opposite interpretation of them than they should, or so I shall argue. Many see these results, and especially the cross-cueing phenomenon, as evidence that split-brain patients have two minds [Sperry (1966); Gazzaniga (1970)]. Some of these theorists even argue that since sectioning CC did not *create* two minds in the split-brain patient, but only *revealed* their prior existence, normal people also have two minds [Puccetti (1973)].

Interestingly, they seemed to come to this conclusion this by applying something similar to PP: the general idea that processes which perform the same function ought to be treated the same, regardless of whether they take place in the brain or in the external (social) world. I'll describe the way I think they (mis)use this principle to make their case for mental duality and then argue that the correct application of the principle to this case yields a much more plausible (indeed, an obviously true) result: each human has just one mind. What we ought to be learning from split-brain syndrome (and from cross-cueing as an accommodation to it) is that the processes that go on in a single mind can spread out beyond the brain proper, beyond the cerebrospinal fluid and blood in which the brain is bathed, beyond the skeletomuscular system, out into the (even more) public world of facial expressions, body movements, speech, and other communicative acts.

It was investigation into the split-brain syndrome that really settled what had previously been mere speculation about the special function of CC. In normal, everyday circumstances, split-brain patients demonstrate no noticeable deficits from their surgery. So, until these deficits were revealed in the split-brain syndrome, it was sensible to think that CC has no special function in the brain. In fact, the function served by CC was being taken over, in-

visibly and efficiently, by other processes in the split-brain patient. The role of CC in communication between the hemispheres was clearly revealed only after laboratory controls were in place to forestall these other processes (to confine perceptual inputs to just one hemisphere and to prevent the use of cross-cueing).

Of course, duplication of information and cross-cueing are processes that are external and social. The surprising thing is that a pair of cerebral hemispheres can use them to cooperate and communicate with one another, but it would be no surprise at all to learn that two different people did these things. Two people might see a movie while sitting silently beside one another (duplication of information) or they might share their thoughts about a play they were seeing by gesturing, making facial expressions, and speaking to one another about it ('cross-cueing'). These processes are among the most familiar means we have of interacting and communicating with one another.

When some researchers learned of the special deficits of split-brain patients and that they naturally fell into using social means of communication between the two hemispheres when important neural pathways between them had been cut off, their response was to claim, in effect, that CC were not subserving a mental process at all, even in normal people. They argued that CC do not join and integrate two parts of the *same* mind, rather they are, in effect, an *external* line of communication between *two* minds that just happen to be located in the same human skull and skin. Since (1) the kind of integration that CC achieves between the two hemispheres by neural pathways is no better than what can be achieved by social processes (such as duplication of information and cross-cueing) and (2) these social processes are commonly used by separate people (with separate minds) to share and communicate information, then (3) the two hemispheres must, themselves, be separate minds.

We have good experimental evidence from hundreds of subjects with hemispherectomies, forty-five years of research on split-brain patients, and many brain imaging studies of all kinds supporting the thesis that there is a good deal of independence (and some variation) in the functioning of the cerebral hemispheres [Bogen (2000)]. This functional independence already suggests that each hemisphere is sufficient to subserve a mind on its own. When we add to this the insight from research into split-brain syndrome that the principal neural connections between the two (CC) are no more special or magical than the social connections between two people who are watching a movie together, the claim that each hemisphere contains its own distinct mind seems even more convincing.

As I have indicated, this inference to belief in mental duality is in large part a wrong-headed application of PP. PP says, 'If, as we confront some task, a part of the world functions as a process which, were it to go on in the head, we would have no hesitation in accepting as part of the cognitive process, then that part of the world is (for that time) part of the cognitive process'.

[Clark (2006), p. 44, citing its first appearance in Clark and Chalmers (1998), p. 9]. But, consider this alternative (the 'parrot-y' or 'parody' principle, PP*): 'If, as we confront some task, a part of the brain functions as a process which, if it were to go on between two people, we would have no hesitation in accepting as part of the external (social) world, then that part of the brain is (for that time) part of the external (social) world'. The odd behaviours that comprise the split-brain syndrome, therefore, seem to indicate that the post-operative patient has two minds, each with its own set of beliefs, intentions, and abilities. And this raises the question: what is the best explanation for this mental duality, given that all that has happened to him is sectioning of a band of nerve fibers? Surely, it would be that there were two distinct minds already in place even *before* the operation.

But, observe what happens when we apply PP* in this way to our original situation of Otto and Inga. Otto remembers an address by writing it down in a notebook that he carries around with him. This is obviously a *social* (external) process. Comparing this to what Inga does 'in her head', we recognize that the same function can be carried out, as it turns out, by using the hippocampus (or whatever) in place of the notebook. But, performing this task by using the hippocampus is not, however, a genuinely *mental* function, this line of thinking goes, because (as PP* requires) even though the hippocampus is part of the brain, that is not sufficient to deny that it is a social (external) process. In other words, we are pushed by PP* to conclude that when Inga remembers an address, she does not use her mind to do it, she merely uses (a non-mental part of) her brain.

It should be pretty clear how our analysis of the split-brain situation would go if we run PP in the right direction (according to me), the way it was originally intended. In the research on the split-brain syndrome, we see evidence that there are functions that are often carried out by a certain part of the brain (CC) but that can also be carried out by external processes (such as information duplication or cross-cueing) in those subjects who lack that part of the brain (and, I am guessing, in normal people, too, probably *all the time*). Therefore, it is evident that at least some brain processes involved in cognition are not so magical, after all, since they can be (and regularly are) smoothly replaced by non-brain processes such as cross-cueing. There is nothing mysterious about cross-cueing. It is a common process which people can use to communicate to one another and to themselves though gesture, facial expression, and language. The fact that a person more-or-less automatically turns to the use of this process when certain neural routes have been cut (and even when they have not) and that when she does this, she is able to bring her behaviour in everyday circumstances up to normal standards shows that nothing significant hangs on the fact that this task is sometimes performed by brain processes. It counts as thinking either way, and, either way, it is a cognitive process. This is just to say that the occurrence of cross-cueing

is a good reason to endorse HEC, the idea that cognitive processes extend out into the world.

One big advantage of this way of doing things is that we get to keep the concept of mind roughly where it is, as a central part of our everyday explanation and understanding of human (and some other animal) behavior [Marks (1981)]. It is largely *behavioural* evidence (the normal behaviour of hemispherectomy patients in many normal situations and the unusual behaviour of split-brain patients in the experimental situations) that leads some of us to the idea of the radical independence of the cerebral hemispheres in the first place. But, on balance, the behavioural evidence from split-brains quite heavily favors the opposite conclusion, because these people act the same as everyone else in nearly every situation. We can explain and predict their behaviour by making reference to a single, more-or-less coherent mind (one that is virtually as coherent as a typical human mind). Whatever dissociations we can contrive for them to produce is not too much for the loose play in our concept of a unified mind to tolerate. And, if we now learn that some of the integrity that they do display is the result of duplication of information between the two hemispheres of the brain and some of it is the result of 'talking to one's self' we should also realize that, most likely, a large part of our own mental integrity is also due to these kinds of 'external' processes.

IV. Mental Duality

Speculation about mind and brain having long been an active area of human interest, the original idea of mental duality turns out to be much older than research done on the split-brain.[9] In 1844, for example, Arthur Ladbroke Wigan, impressed by the fact that when a person suffers the destruction or removal of one brain hemisphere, he can retain most of his mental abilities, argued that one cerebral hemisphere is enough '... for the emotion, sentiments, and faculties which we call, in the aggregate, mind' [Wigan (1844), p. 271]. He would certainly have been impressed, had he known as we now do, that some mammals (dolphin, for example) are able to sleep with one hemisphere while remaining awake with the other [Bogen (1983)].

Wigan came to conclude that a normal human has two minds that coordinate and cooperate with one another so long as he enjoys a healthy mental life. Wigan theorized that many mental illnesses are the result of breakdowns in the communication between the two hemispheres (minds), perhaps due to problems with CC. On his view, the onset of many mental illnesses simply reveals (rather than creates) the mental duality that is already in place but is concealed by effective integrative processes.

And, according to McDougall (1911), long before the first split-brain surgeries had been performed, nineteenth-century psychologists Gustav Fechner

and Eduard von Hartmann speculated that sectioning CC would produce two separate streams of consciousness (although they both thought that the operation was medically impossible to perform).[10] Von Hartmann's reasoning was that, as he says, 'We may lay it down...as a principle: separate material parts give separate consciousness' [von Hartmann (1884) quoted in Zangwill (1974), pp. 264-65]. Since each hemisphere is capable of supporting consciousness on its own, if they were separated from each other (by sectioning their main line of communication), then a single human would have two separate streams of consciousness.

Now, von Hartmann's own main opponents, like McDougall, were metaphysical dualists who held that consciousness could (and would) remain unified even if the brain were to be divided, because dividing the *brain* should have no effect on the *real* ('internal', perhaps in the sense of *private* or *immaterial*, and certainly in a sense that excludes both body and brain) seat of mind and consciousness, namely the *soul*. McDougall went so far as to tell a friend of his, a surgeon, that if the opportunity should arise at some point, perhaps in the last hours before McDougall's death, the surgeon should sever his CC, just so that it could be determined whether that would also split his consciousness. McDougall predicted that his consciousness would remain unified after the operation. We now know that if McDougall had undergone the operation, he would have thought his prediction had come true. Genuine split-brain patients testify that they experience no split in mind as a result of the surgery.

Lingering effects of this way of setting the debate – dualists on the side of unified consciousness (a single mind) and materialists on the side of split consciousness (dual minds) – might also help to explain the present popularity of the mental duality interpretation. Maintaining the materialist approach would have seemed, to at least some thinkers in Victorian times and to many people today, to be a far superior alternative to anything approaching a dualist line of thinking. Contemporary theorists add the considerations from the split-brain syndrome to the evidence for their side, overlooking the fact that the syndrome appears only under laboratory conditions. They are comfortable, in the spirit of objective scientific inquiry, simply to deny the validity of introspection-based testimony of mental unity from split-brain patients themselves. And, their position is consistent with their intuition that 'the occult appearance of the processes of thinking' requires us to find a magical system to subserve those processes (not that they would use this way of describing their view).

These days, however, the metaphysical dualist position does not dominate the field, as it once did. The crux of the debate has shifted to the conflict between the two contemporary materialist positions I have been calling: 'internalist' and 'externalist'. The contemporary internalist position is the result of externalizing the traditional internalist position: soul-based metaphysical

dualism. Bringing the mind "out of" the soul and into the brain literalized the sense in which the mind is internal and established a tangible boundary (the skull or skin) between mind and world (a boundary that was lacking, or perhaps not required, in the soul-based model). Advocates of HEC (contemporary externalists) seek to continue this salutary trend. They call attention to the arbitrariness of the boundary that internalists value so highly and to the naturalness and fluidity of the ways in which the mind operates in the world. I have argued here that the evidence from split-brain cases is a good demonstration of the ease with which the mind integrates itself into the world outside the human brain and body.

V. AFTERTHOUGHTS

It should not take the discovery of cross-cueing for us to know how to resist the idea that mind is *even more internal* than we thought it was. Consideration of the split-brain syndrome should not motivate us to say: 'we had believed that a mind was seated in the whole intact brain, but we now realize that it is in the single intact hemisphere'. Persisting in this line of reasoning as cognitive neuroscience reveals more and more of the functional anatomy of the brain will lead us even further in the wrong direction. We will find ourselves claiming that it is not even the intact hemisphere, but rather the thalamus or the reticular formation that is the *real* seat of the mind, and this chase into the interior of the brain has no real prospects for success [Bittner (2004)]. Each smaller brain structure seems a marginally better candidate to subserve mental unity than the larger ones of which it is a part. But, we won't find satisfaction in this search until we abandon our materialism altogether, as we find ourselves dissatisfied with any physical system more substantial than a dimensionless, geometrical point.

A better line would be that a mind does not have the kind of perfect unity that 'must be somewhere in there' in the head or in the brain, and that requires a tangible (or metaphysical) boundary to preserve it. A mind enjoys a much more mundane kind of unity, the looser unity of an individual person, made up of many parts, both bodily (including the brain) and even environmental, over which are distributed the heavy information-processing load of carrying on a human life.

In connection with his speculations about the possible effects on the mind of splitting the intact brain, von Hartmann claimed that 'if the brains of two men could effectively be joined by a bridge of nervous matter, as the two halves of the human brain are joined by the corpus callosum, the two men would have a single, common consciousness'.[11] In the same way that the word 'reasonable' helps legislators draft laws that actually work in application to the contingencies of real life, von Hartmann's prediction is safeguarded by the

word, 'effectively'. Still, I take him to be claiming, in the internalist spirit, that what really matters for mental integration are neural connections and not information-processing power. I believe that even back then, it should have been apparent that von Hartmann's conjecture is false, but instructive, because it makes it easier to see the implausibility of the view that neuronal processes have any inherent capacity to give rise to mentality.

To make a single mind out of two hemispheres, it would take both more and less than 'a bridge of nervous matter' between them. It would take a lifetime of common experiences and cooperation. If two hemispheres had these things in common, I do not know how crucially important also having the nervous connection between them would be. As we have seen, all the functions of this bridge could be carried out in other ways.

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NOTES

1 See Rowlands (2003) pp. 189-201 for some considerations in favor of the view that consciousness, too, is partly external.

[2] For soul-based internalists, such as Descartes, all physical systems, including brains, count as external. See Huxley (1874). See, also, Chalmers (1996).

[3] Compare the discussion of 'the occult appearance of the processes of thinking' in Wittgenstein (1958).

[4] For most people, the intermediate case of explaining how an electronic device, such as a computer, can be used to remember something combines total confidence in the *existence* of a comprehensive technical explanation with near total incompetence even to begin *giving* such an explanation. Computers are not magical, although most of the time, for most of us, they might as well be.

[5] Monotremes, such as the platypus, and marsupials, such as the kangaroo, do not have CC.

[6] This remark is attributed to Warren McCulloch in Marks (1981), p. 4.

[7] Some split-brain patients also exhibit so-called alien hand syndrome. See Scepkowski and Cronin-Golomb (2003).

[8] Logic suggests, falsely, that it is not possible for a person to believe that one number is larger than another without also believing that the two numbers are different from one another.

[9] Even basic facts of gross brain anatomy – e.g. the brain's division into two halves – already suggest some form of mental duality.

[10] Here, Fechner and von Hartmann use 'stream of consciousness' as a general term for a unified mind and mental functioning, which includes cognition. 'Con-

sciousness' had not yet come to refer exclusively to the phenomenal features of mentality in contrast to cognitive functioning. Their usage is closer to Descartes' view that the essence of mentality (consciousness) is cognition and intentionality. Sensations and feelings – what we now refer to as (phenomenal) consciousness – are 'mixed modes' for Descartes, partly mental and partly bodily.

[11] von Hartmann (1884). Again, we should read him as asserting that they would have 'a single, common mind'.

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