

## Action, the Unity of Consciousness, and Vehicle Externalism<sup>1</sup>

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### 1. Is partial unity of consciousness possible?

Some conscious states occupying the same stretch of time are together, while others are separate. While I talk to you, I see your face and hear my own voice. These experiences are together or united within one consciousness: they are co-conscious. But you also hear my voice, and your experience is separate from mine.

We have an intuitive, pretheoretical idea that two conscious states must either be together, co-conscious, or separate, not co-conscious. But *what is it* for simultaneous conscious states to be united or separate? Can we give an account of the unity of consciousness that will apply not just to easy cases like the example I just gave, but also to various hard cases described by neuropsychologists? I'm going to focus here on just one aspect of this question: is it necessary for consciousness to be fully unified, or is it possible for consciousness to be only partially unified? Keep in mind that my topic is not personal identity over time, but the unity of consciousness at a time.

We normally assume that consciousness must be fully unified. What does this mean? We can use the intuitive idea of togetherness or co-consciousness to explain full unity. Full unity requires that if two conscious states are co-conscious at a time, then each is also co-conscious with all the states the other is co-conscious with at that time. That is, full unity requires that *...is co-conscious and simultaneous with...* is a transitive relation between conscious states.

A partially unified consciousness would not satisfy this assumption of transitivity. In a partially unified consciousness, two states that are not co-conscious with each other can nevertheless both be co-conscious with the same third state. At a given time, experience *x* could be co-conscious with experience *y* and the very same experience *y* with experience *z*, but experience *x* nevertheless be separate from experience *z*. If partial unity is possible, then consciousness can have this kind of branching structure. Is partial unity possible, or is the usual assumption that consciousness must be fully unified correct?

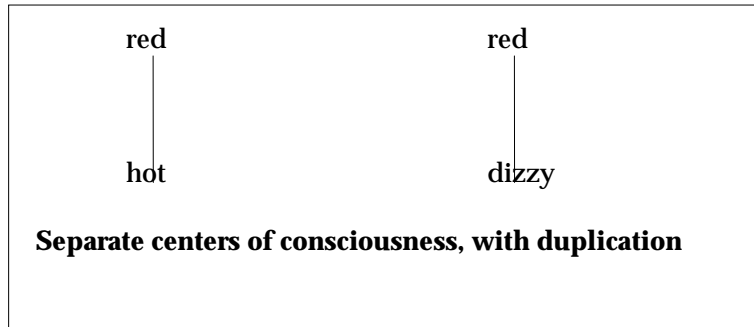
### 2. Why the “what it is like” approach cannot tell us whether partial unity is possible.

It seems difficult to imagine what it would be like to have a partially unified consciousness (Lockwood 1994, p. 95; cf. Snowdon 1995). But this doesn't show that partial unity is not possible. We shouldn't expect to be able to imagine partial unity. Being partially unified is not the kind of thing there *could* be anything it is like to be. I'll explain why.

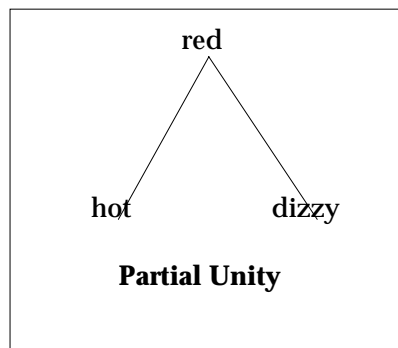
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<sup>1</sup> I am grateful to Harvard University Press for permission to use in this chapter adapted and revised material from *Consciousness in Action*, by S. L. Hurley, Cambridge, Mass: Harvard University Press, Copyright 1998, by the President and Fellows of Harvard College.

It is easy to imagine what it is like to have co-conscious experiences with certain contents: to imagine seeing red and feeling hot, or to imagine seeing red while feeling dizzy. We can also easily imagine that no experience of feeling hot is together with an experience of feeling dizzy. But this is not to imagine partial unity. I could be seeing red while feeling hot, and you could be seeing red while feeling dizzy. That wouldn't be partial unity, because my experience of seeing red isn't the same particular experience as yours, even though it may be the same qualitative type of experience as yours, with the same content. There would be no violation of transitivity of co-consciousness here, because there would be two distinct separate experiences of seeing red, mine and yours.



To imagine a partially unified consciousness, we must imagine something not just about the type and content of experiences, but also something about their identity. We'd have to imagine that some experience of seeing red that is together with an experience of feeling hot is the very same particular experience as an experience of seeing red that is together with an experience of feeling dizzy--even though that experience of feeling hot is not together with that experience of feeling dizzy.



It certainly is hard to imagine what this would be like. But that is because there is nothing it is like for experiences with the same content to be identical or different. There is something it is like to see red, or for seeing red to be co-conscious with other experiences. But there is nothing it is like for my experience of seeing red not to be identical with your duplicate experience of seeing red. Nor is there anything it is like for my experience of seeing red to be identical with itself. The "what it's like" talk just doesn't apply to the identity of experiences in these ways. So being partially unified isn't the kind of thing the purely subjective perspective expressed by the "what it is like" talk could in principle get a grip on at all.

There is a more general lesson here. It is natural to assume that if partial unity of consciousness is intelligible, there should be something distinctive it is like for there to be partial

unity. After all, partial unity is a supposition about consciousness. But this assumption is wrong. Duplication of an experience of seeing red, in me and in you, is perfectly intelligible. But there is nothing distinctive it is like for there to be such duplication. Suppositions about the structure of consciousness, or the identity of conscious states, need not be captured by “what it is like” talk. Yet some such suppositions are essential to the concept of consciousness: consciousness must have some determinate structure or other. It cannot be an amorphous cloud. So the idea of “what it is like” does not exhaust what is essential to the concept of consciousness. The lesson is: consciousness is not purely subjective in this sense; there must be more to it than “what it is like”. Some kind of objective account is needed of the structure of consciousness.

If partial unity is possible, then there has to be something that makes it the case that, to take my example, there is one experience of seeing red rather than merely duplicate experiences of seeing red. There has to be a difference between partial unity and duplication. But this difference cannot be purely subjective, purely a matter of “what it is like”.

So: it’s no wonder we cannot imagine what partial unity would be like! But that does not show that partial unity is not possible. There may be some objective basis for the distinction, which makes partial unity possible. However, it is not enough simply to assert realism about experiences, that there is some fact of the matter on this issue even if it hard for us to gain knowledge of it. We’re trying to understand what this fact could be, to open the realist’s black box. What kind of objective fact could in principle make a case one of partial unity rather than duplication?

### 3. Neuropsychology: examples of partial unity?

To this end, let’s consider some work in neuropsychology that it is tempting to interpret as illustrating partial unity of consciousness. Maybe these examples will help to see how partial unity could be objectively different from duplication. I’ll focus on two examples, a commissurotomy case described by Colwyn Trevarthen and some results with normal subjects from Tony Marcel. These cases suggest two different approaches to the question of partial unity, one in terms of neural isomorphism, the other in terms of motor factors.

First, we could assume that there is an isomorphism between the structure of consciousness and neural structure. Then maybe consciousness is partially unified in certain cases because there is partial unity of neuroanatomical structure. I’ll argue that this isomorphism assumption is not justified.

Second, I will consider the way these cases challenge a widespread assumption, namely, that perceptual experience does not depend directly on motor factors. I will show how rejecting this assumption can dissolve the puzzles about partial unity in these cases.

This is not intended to be a conclusive argument against the possibility of partial unity. It’s more in the way of a diagnosis of the assumptions that can make it tempting.

### 4. Trevarthen’s case and the isomorphism assumption.

I'll begin with a commissurotomy case described by Trevarthen. Trevarthen's own interpretation of this case illustrates the isomorphism assumption, which I'll argue against. I'll then consider a different interpretation of this case, in terms of action and motor feedback.

Trevarthen's patient was trying to do a left hand task relating to an object in the right visual field while fixating a central point. Fixating is supposed to insure that information from each half of the visual field reaches only the contralateral hemisphere. Trevarthen reports that the patient in this case

... could not respond and described the shape as vanishing immediately the movement began....Here the patient's testimony was that the image of the object, initially seen, was blotted out of awareness in the left hemisphere the instant a movement, initiated by the right hemisphere, had started....While the subject kept in readiness to respond, intently fixating...[the object] was invisible, even when moved, until the instant it crossed the vertical meridian. Appearance of the corner of the card past the midline in the left visual field triggered a forceful and rapid response with the waiting left hand. (Trevarthen 1984, p. 333)

What's happening here? By asking the patient to do a left-hand task relating to a card in the right visual field, Trevarthen makes conflicting demands. The left hand is controlled by the right hemisphere, which receives information from the left visual field, not the right, during fixation. The intention to respond with the left hand seems to be co-conscious with the perception of the left visual field, in which there is no card, but not with perception of the right visual field, in which there is a card. On the other hand, speech is controlled by the left hemisphere, which receives information from the right visual field, not the left, during fixation. The background procedural intentions, to cooperate and respond and communicate, manifested in the patient's remarks, seem to be co-conscious initially with perception of the right visual field, in which there is a card. Yet these background intentions seem to be co-conscious with the left-hand motor intention and, once the movement begins, with perception of the left visual field, in which there is no card. So the patient might say: "It's disappeared!"

Trevarthen interprets this case in a way that suggests partial unity, on isomorphism grounds. Commissurotomy creates disunity at the cortical level, but leaves subcortical unity intact. Trevarthen finds reason to think the structure of consciousness may be isomorphic with this neuroanatomical structure. He claims that the "...two-way links of hemispheres with the brain stem, as well as the links with the body itself, make complete surgical duplication of consciousness in man an impossibility" and that the case "...require[s] interpretation in terms of a representation of the visual field in the undivided parts of the brain that are in functional communication with both hemispheres at once...."<sup>2</sup>

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<sup>2</sup> Trevarthen 1974a, pp. 247, 257. Trevarthen also discusses a cluster of functional distinctions: the 'what'/'where' distinction, the focal/ambient distinction, the distal/proximal distinction. He shows how the combination of unity for some functions and disunity for others in various patients relates closely to the neuroanatomical structure, subcortical unity and cortical disunity, in commissurotomy patients. Roughly, the idea is that certain focal, qualitative and distal functions are located in cortex, so subject to disunification, while the unity of certain ambient, quantitative and proximal functions can at the same time be supported subcortically. He comments:

Taking neuroanatomical isomorphism as grounds for partial unity is intuitively appealing in cases where there are only limited dissociations and neuroanatomical structure is very close to normal. Suppose a patient shows a few dissociations after surgery that severs only a small portion of his corpus callosum (see Lockwood 1989, p. 90.) Here it would seem extravagant to permit a few instances of disunity to cut a swathe through the whole structure of consciousness. If we do not allow partial unity in such a case, then most of the contents of consciousness must be duplicated to accommodate a few cases of dissociation. While this is logically possible, it may seem more natural in such a case to let the structure of consciousness be guided by the structure of neuroanatomy, which is partially unified.

#### 5. Objections to the isomorphism approach, and vehicle externalism.

Consider some objections to the assumption that the structure of consciousness is isomorphic with neuroanatomical structure.

First, it might be objected that subcortical mechanisms do not normally support consciousness, even though they do process information. So subcortical unity does not support partial unity of *consciousness*--as opposed to some corresponding claim about information, which may not all be conscious.

This is a good point. But I think there is a second, philosophically more basic, objection to the isomorphism approach, which holds even if this first objection is waived. This more basic objection is closely related to a point emphasized by Dennett (1991a) and Millikan (1993). They distinguish properties of vehicles of content, such as brain states or processes, and properties represented in content. We should not assume that the vehicles of content always represent some property by themselves having that property. They *can* do so, as

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It appears that when the cerebral hemispheres are disconnected, cross-integration of certain attributes of visual perception of objects in space and their motions are retained in the periphery particularly, ... while perception of identity and of detailed features in the central field is divided. (Trevarthen and Sperry 1973, pp. 547, 568-9)

Vision of space at large, detected by the whole retina, is mediated through subhemispheric mechanisms; but foveal vision of detail, essential to full conscious perception of the substances of surroundings and of the identities of objects, is mediated by a hemispheric or cerebral cortical mechanism. ...We asked [commissurotomy subjects] to tell us, presumably using their left hemispheres, about visual experiences in the peripheral left visual field. The left visual field, of course, projects to the striate cortex of the right hemisphere exclusively. However, there are large extrastriate visual projections in man. The tests are designed to explore what the alternate visual route through the midbrain contributes to human awareness. We found that a partially conscious or subconscious perception of space, detecting kinetic transformations within the visual array, remains a unified process in the brains of these subjects. In it left and right visual fields are represented together. (Trevarthen 1978, p. 114)

See Hurley 1998, essay 5, for further discussion.

in the case of spatial relations represented topographically in cortex. But this isn't necessary. To take an obvious example, representations of greenness need not be carried by green brain states. Less obviously, representations of simultaneity need not be carried by simultaneous brain states (Dennett 1991, Dennett and Kinsbourne, 1992). Content is easy-going; it will take a ride wherever it finds one.

The point can be extended from the content of consciousness to the structure of consciousness. The structure of vehicles of consciousness may not be isomorphic with the structure of consciousness itself. A variety of vehicular structures, with only functional unity in common, might support a unified consciousness. This general objection applies to the view that structural isomorphism supports a partial unity reading of Trevarthen's case (see also Lockwood 1989, pp. 89-90).

To begin to undermine the isomorphism view, notice how differences of neurological structure appear to cut across differences of the structure of consciousness. On the one hand, the corpus callosum is intact in subjects with normally unified consciousness. But it can also be intact in cases of multiple personality, where speech and action argue for several separate centers of consciousness, perhaps with some duplication of contents. On the other hand, the corpus callosum is surgically severed in commissurotomy patients, who seem to support separate centers of consciousness. But the corpus callosum is congenitally absent in callosal agenesis patients, where speech and action argue for a unified consciousness. Acallosals typically pass the tests for unity that commissurotomy patients fail (see Jeeves 1965; Milner and Jeeves 1979; Diamond 1972, pp. 61-66).

To pursue this second objection, let's consider how acallosals might integrate information to enable them to display unity. In principle, they could depend on either wholly internal or partly external mechanisms of integration. Internal mechanisms could be ipsilateral and subcortical neural pathways. Partly external mechanisms could involve motor activities that distribute or transfer information across the hemispheres, such as access movements or cross cuing. For example, access movements could be habitual side to side movements of the head or body that give each half-brain direct sensory inputs from objects that would otherwise appear in only one half-brain's visual field. Cross-cuing could be by means of facial expressions or gestures accessible to both sides, which function to transfer information from one side to the other (see Bogen 1990). Such partly external mechanisms of integration depend on feedback from motor activity rather than purely neurological unity. We can call them "extended" mechanisms of integration.

The tests of unity that discriminate between between commissurotomy and acallosal subjects are given under controlled experimental conditions designed to exclude cross cuing and access movements. So, if the experiments succeed in this aim, it appears that acallosals do in fact depend on internal, neural mechanisms of integration. But this doesn't make partly external, or extended, mechanisms irrelevant in principle. Perhaps some extended mechanisms might be so subtle and automatic that they evade experimental control. And even if this is not the case, at least in ordinary uncontrolled circumstances, extended mechanisms could also serve to integrate information. Marcel Kinsbourne remarks that the absence of the corpus callosum is biologically trivial, since minor adjustments in orientation distribute the same information to both sides (1974).<sup>3</sup>

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<sup>3</sup> In a talk given at the Radcliffe Infirmary in Oxford, February 1987, Christine Temple reported that one of her acallosal patients has peculiar visual examination habits, such as approaching things from the side and looking at them out of the side

I now want to do some thought experiments comparing hypothetical cases. I will make comparisons between various hypothetical cases, in order to argue that there is no reason in principle why an extended mechanism of integration could not operate on a par with a wholly internal mechanism of integration, in providing the vehicle of a unified consciousness.

Suppose a recently-operated commissurotomy patient uses a partly external mechanism of integration. For example, if access movements are prevented, a smile appears to signals that “yes” is the right answer to a question. This would naturally be taken as evidence of disunity of consciousness and an attempt to communicate information between two separate centers of consciousness (see Gazzaniga 1988, p. 223). The fact that the mechanism of integration is partly external here appears to have implications for the structure of consciousness.

By comparison, if an acallosal subject were to depend on a partly external mechanism of integration, it would not have the same implications. It would not provide evidence of disunity in the same way. Why not? Suppose the acallosal has always depended in everyday life primarily on extended rather than purely internal mechanisms of integration. This involves subtle forms of cross-cuing and access movements that are not properly described at the personal level as rationally controlled, intentional actions. Rather, they function smoothly and automatically at a subpersonal level to integrate information. It was never the case that the acallosal harbored separate centers of consciousness and agency, somehow formed, structured, and unified independently of the partly external mechanisms. It was never the case that such prior separate units of consciousness hit on the use of external paths as a way of communicating between themselves. This person’s consciousness, including its structure, emerged and developed with partly external mechanisms in play. These extended mechanisms of integration are among the vehicles of her unified conscious states.

Next, compare two hypothetical acallosal patients. One has developed so as to depend mainly on extended mechanisms of integration in everyday life, as just described. The other has developed so as to depend mainly on purely internal mechanisms. Both display unity in a wide range of circumstances. In both cases, from the start the process of acquiring conscious contentful experience, intentions and language, through brain/body/environment interactions, has involved these acallosal mechanisms of integration. Therefore, in neither case should the patient be regarded as harboring two separate, communicating centers of consciousness and agency. In principle, reliable external mechanisms of integration that use motor feedback loops are no less qualified than internal neural mechanisms of integration to function as the vehicles of co-conscious contents and a unified consciousness.

It may be said that this comparison turns on whether the subject has a certain kind of personal level access to the mechanisms of integration in each case. Suppose we segregate inputs to the left and right half brains and ask these acallosals a yes/no question that requires comparison or integration of the separate inputs to answer. Both answer correctly. We then ask them how they know the answer.<sup>4</sup>

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of the eyes (perhaps thereby trying to get objects into one half of the visual field?). However, in a talk given at the Department of Experimental Psychology in Oxford, May 1987, M.A. Jeeves discounted the possibility that motor adjustments contribute greatly to the extra unification manifested by acallosals.

<sup>4</sup> Here I’m indebted to Zoltan Dienes for discussion of related points.

There are several possible scenarios. Both could say: I don't know it; I just do. This answer would not threaten the unity of consciousness, in either the internal or the external case.

Or, both could be sophisticated subjects who have learned about their own nonstandard mechanisms of integration, so that each gives a roughly correct description of the respective mechanisms that enable them to know the answer. One says: the information that allows me to answer correctly is carried subcortically in my brain. The other says: the information that allows me to answer correctly is carried by small movements of the muscles of my face. The unity of consciousness is not threatened by the knowledge these answers express because it is indirect. The mechanism of integration is not something that the subject is directly conscious of or in control of, in either case.

Suppose next that the subjects are directly conscious of and in control of the mechanisms of integration. The internally integrated acallosal has, as a result of years of training in biofeedback and meditation techniques in conjunction with brain scanning, gained direct awareness and control of certain of his information states and processes. He truthfully says: "I am directly conscious of information represented in *this* area, and I can decide whether or not to send it to *that* area, using the following subcortical path (pointing to the scanned image). If I do send it, I can make the comparisons that enable me to answer the question. If I were to decide not to send the information in this way, I would be unable to answer the question."

This is a fairly weird scenario, and I am not sure what to say about it. Is the unity of consciousness lost as this kind of direct consciousness and control is gained? My point, here, however, is that it is just as difficult, and difficult in the same ways, as the parallel scenario for the externally integrated acallosal. Suppose she has, as a result of similar training that additionally involves the study of her own mirror image as she answers questions that require external integration, gained direct awareness and control of certain of her information states and processes. She truthfully says: "I am directly conscious of information represented in *this* area of my face, and I can decide whether or not to send it to *that* area, by means of signals that use these facial muscles (pointing to the mirror image of her face). If I do send it, I can make the comparisons that enable me to answer the question. If I were to decide not to send the information in this way, I would be unable to answer the question." There is so far no apparent asymmetry between the issues raised by internal and by external mechanisms of integration.

But, it may be objected, the externally integrated acallosal doesn't have to acquire, through elaborate biofeedback procedures, awareness of the state of her face--say, whether she is smiling or frowning--or the ability to control such states intentionally. It is normal to know whether you are smiling or not, and to be able to smile intentionally, whereas it is not normal to know what subcortical states you are in and to be able to control subcortical processes intentionally. It is thus possible that the externally integrated acallosal, when asked how she knows the answer to the question that requires integration, can simply say something like: "I knew because I smiled intentionally and my nose wrinkled in reply." That, surely, would threaten the unity of consciousness, and that possibility does not arise for internal integration.

In response, I suggest that in some cases but not others the movements of facial muscles that do the relevant work may be directly accessible and controllable. Where they are, I can admit for the sake of argument that consciousness may not be unified. But where they are not, consciousness may well be unified, despite the extended character of the mechanism of integration.

My claim is not that reliable extended mechanisms of integration must always be part of what underwrites a unified consciousness, but rather that they can be. The difference between unity

and disunity does not turn simply on the difference between internal and partly external mechanisms of integration

Suppose an externally integrated acallosal with a unified consciousness were placed under experimental controls that prevented the external mechanisms from functioning. In the absence of internal mechanisms to fall back on, this would be equivalent to a surgical division, albeit temporary: it would alter the structure of consciousness. By contrast, to place a recently-operated commissurotomy patient under these conditions would arguably not alter the structure of consciousness, but would merely block certain channels of communication between two separate centers of consciousness. But perhaps over time a commissurotomy patient might adapt, so that partly external mechanisms of integration come to operate as subpersonal vehicles of a unified consciousness, in the way they do for the externally unified acallosal.

The point these thought experiments are driving at is that, in principle, a partly external mechanism of integration could be part of the causal system that supports the very unity of consciousness itself. There is nothing magical about this possibility: it appeals to a system of causes and effects in a perfectly naturalistic way, even though some causal paths go external. Indeed, the point depends on recognizing that there is no magical causal boundary around the brain that in principle prevents the vehicles of a unified consciousness from spreading beyond it. This is the insight of *vehicle externalism*. Instead, we can think of the subpersonal basis of a unified consciousness as a kind of *dynamic singularity* in the field of causal flows: a tangle of multiple feedback loops of varying orbits, some internal to the brain or body, others involving partly external motor feedback. Such a dynamic singularity is centered on the organism and moves around with it, but it does not have sharp boundaries (see Hurley 1998 for further discussion of vehicle externalism and the notion of a dynamic singularity).

Finally, let me spell out how this point bears on the isomorphism approach to the structure of consciousness and to the question of partial unity. I have argued that it is possible that an acallosal who depends on partly external mechanisms of integration could nevertheless have a fully unified consciousness. If so, then the structure of her consciousness is not necessarily isomorphic with her only partially unified neuroanatomy. It may be an open question whether her consciousness is fully unified, but at least the answer cannot just be read off from her neuroanatomy. We can't simply project neuroanatomical structure onto consciousness.

However, there may be a weaker sense in which an isomorphism does hold.<sup>5</sup> I suggested that a unified consciousness could be carried by a functionally unified system of causal relations, a dynamic singularity. Perhaps a unified consciousness must have a unified vehicle after all, at least in this functional sense. Such functional unity would of course have neurophysiological aspects and effects, but it could in principle depend on external motor feedback loops as well as internal neural paths.

Back to Trevarthen's commissurotomy case: where have we got to? The interpretation of it in terms of partial unity, based on partial unity of neuroanatomical structure--subcortical unity and cortical disunity--has been thrown into doubt. It seems to assume a kind of isomorphism between neural structure and the structure of consciousness that does not necessarily hold.

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<sup>5</sup> Though there is a danger of trivializing the idea of isomorphism, if whatever the subpersonal basis of the unity of consciousness turns out to be is counted as having the kind of functional unity to which the structure of consciousness is isomorphic.

## 6. Trevarthen's case again: a diagnosis and motor dependence.

Here's a different approach, an attempt to diagnose Trevarthen's case. What is so puzzling about it? What further background assumptions might be pushing us in the direction of a partial unity interpretation?

Trevarthen's case is puzzling in at least three distinct ways. When the right hemisphere gets ready for a left hand motor response, the *right* half of the visual field becomes inaccessible to verbal report by the left hemisphere. Instead, the *left* half of the visual field becomes accessible to verbal report.

First, we want to know: when this shift occurs, what happens to the information about the right visual field that is no longer verbally accessible? Is it merely somehow separately conscious, or it is no longer conscious at all? What could give us a handle on this difference, the difference between presence in a separate consciousness, and absence from consciousness altogether? We can call this the "separate-or-absent question". It is a kind of internalized zombie question. It arises not just in commissurotomy cases, but also in a range of cases where implicit and explicit abilities to use information dissociate, such as blindsight. Concerning such cases, we ask: For information to be conscious, is it necessary that it can be used explicitly? Is it necessary that it participate in some minimal level of global complexity and inferential coherence? Are there limits to how fragmentary information can be while still being conscious?

Second, we want to know whether partial unity is yet another alternative here, along with "separate" and "absent". Could it be that right field and left field visual experiences are not co-conscious, yet both are co-conscious with other background conscious states, such as intentions to do what the experimenter asks, and so on. If this is possible, what would differentiate the partial unity alternative from the other two? In particular, what would the stipulated structural distinction between partial unity and two separate centers of consciousness really come down to, given that all the relevant states are conscious states on both accounts? Is this a distinction without a determinate difference?

We've already followed a few leads here, to no avail. The difference between partial unity and separate centers of consciousness cannot be understood purely subjectively, in terms of "what it is like". Some objective account of the difference is needed. Following Trevarthen's lead, we considered neuroanatomy as a possible basis for the distinction. But we found the assumption that the structure of consciousness is isomorphic with neuroanatomy to be unjustified.

Third, Trevarthen's case has another puzzling aspect, which is the way it suggests that the content of perceptual experience might depend directly on motor intentions. This, I suggest, is really the heart of the matter. Both the partial unity and the separate centers of consciousness readings neglect this feature of the case. The onset of the immediate intention to move the left hand itself seems to alter the contents of visual consciousness. Suppose this occurs at time  $t$ . Perhaps before  $t$ , left field visual experiences were co-conscious with background intentions, while after  $t$ , right field visual experiences were co-conscious with background intentions. On this view, at no time was there either partial unity or separate centers of consciousness. Moreover, this temporal distinction registers something reassuringly real, the onset of the motor

intention. It is not just an ad hoc move to avoid the oddness of partial unity, in the way distinguishing wholly separate centers of consciousness may seem to be.<sup>6</sup>

It is natural to overlook this dynamic motor interpretation for a simple reason: the relevant sensory inputs appear to be constant just before and just after *t*, even though intentions or motor output change. And we tend to assume that the content of perceptual experience depends directly on sensory inputs, but not on intentions or motor outputs.

Of course, my moving intentionally can be a *means* to different sensory inputs and thus to different perceptual experiences: turning my head lets me see who has come through the door. It's no surprise that perceptual experience can depend instrumentally in this way on motor factors. But Trevarthen's case is not like that. Rather, it suggests that perceptual experience can vary directly, not just instrumentally, with intentions, even though sensory inputs are constant. The card is seen in the left visual field, the left hand begins to respond, and then the left visual field disappears from consciousness. But the card is still there and the patient is still fixating, so that relevant sensory inputs from the card have not changed.

This reading of the case clashes with a widespread background assumption: that motor intentions and actions are causally 'downstream' from conscious perceptual states and thought. We thus implicitly resist and avoid the idea that perceptual experience can depend directly on motor factors. This is why we naturally overlook the dynamic motor interpretation of this case, and get stuck with the problem of whether there is any determinate difference between partial unity and separate centers of consciousness. But perhaps this widespread assumption should be challenged. It is part of what I call the Input-Output Picture of perception and action, which I argue against elsewhere (Hurley 1998). For present purposes, the point is that rejecting this common assumption provides a way of avoiding the puzzle about partial unity.

Here's an objection to this diagnosis of what is at stake in Trevarthen's case. I claim that the case suggests that perceptual experience can depend directly on motor intentions, in a way that runs counter to our usual assumptions. But consider familiar aspect shifts, such as the duck-rabbit shift or the face-vase shift. Our intentions to attend to one aspect rather than another of an object can change our perceptual experience, even though sensory inputs are constant. But this is very familiar, and contravenes no widespread assumption.

In reply: such aspect shifts are not motor-dependent perceptual experiences, so not counterexamples to my position. When I intentionally shift my attention in such a case, I intend to become conscious of something in a certain way: to become conscious of this drawing as a drawing of a rabbit, for example. This is not a motor intention, and it is cognitively and conceptually quite sophisticated. By contrast, cases that challenge our usual assumptions are cases in which perceptual experience seems to depend directly on unsophisticated motor intentions. Trevarthen's case is in this category. A simpler example is that of the paralyzed eye: when someone with paralyzed eye muscles tries, and fails, to move his eyes sideways, it looks to him as if the world jumps sideways (see Gallistel 1980, p. 175; Shebilske 1984; Hurley 1998, essay 9, for discussion and related cases).

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<sup>6</sup> The motor-dependence interpretation appeals to motor intentions rather than to proprioceptive feedback from intentional movement. A fuller discussion of motor-dependence would try to factor out the role of proprioception, to distinguish it from the role of intentions. I discuss this matter in Hurley 1998, especially ch. 9, but there is not space to develop the issue here.

But this isn't the end of the objection.<sup>7</sup> Changes in attention often accompany changes in motor intentions; perhaps attention rather than intention is doing the work. So, a rival view of Trevarthen's case could appeal to a change of attention that accompanies the onset of the motor intention rather than the intention per se, to account for changes in perceptual experience. After all, in cases of inattentive blindness, attention appears to determine what information is conscious. Perhaps in Trevarthen's case, perceptual experience depends directly on attention rather than on a motor intention. If so, then we can avoid the puzzle about what objective difference there could be between partial unity and separate centers of consciousness without making the motor dependence challenge to standard assumptions.

This is a good point. I agree that it is possible that attention is playing this role in various cases, though it is not yet clear whether attention or intention is in fact doing the work, or how these two hypotheses are to be empirically distinguished. Indeed, a premotor theory of attention accounts for attention in terms of motor intentions, in effect viewing attention itself as motor-dependent (see for example Sheliga et al 1997).<sup>8</sup> However, there are other cases, such as Marcel's cases, in which perceptual experiences appear to be motor-dependent in a way that cannot be accounted for in terms of attention. And the puzzle about partial unity also arises in Marcel's cases. So I now turn to these cases.

#### 7. Marcel's cases: action, feedback, and unity.

Marcel (1993, 1994) asked normal subjects to judge whether they had seen a light, displayed for one second in a known position at threshold luminance. He asked them to respond to seeing a light in three different ways: by blinking, by pushing a button, and verbally. For some blocks of trials, they were asked to respond in just one way, while in other blocks they were asked to respond in all three ways simultaneously. For some blocks of trials they were asked to guess, while for others they were asked to report a definite conscious experience. Some responses were speeded, others were not.

When subjects were reporting conscious experience under time pressure, there were dissociations between response types: blinks were the most accurate, and verbal responses least accurate. This pattern obtained when all three types of response were required simultaneously, as well as across single-response trials. So on some trials requiring three simultaneous response types, one response type would indicate that a light was seen while another would not. Response type dissociations did not occur (or were minimal) when subjects were guessing as opposed to reporting conscious experience, or when reports were made at leisure.<sup>9</sup>

It might be tempting to explain inconsistencies between simultaneous reports in terms of unconscious information. Marcel argues against this view. The report latencies are too long for reflexes. When asked, subjects insist their responses in the report mode are indeed reports of conscious experience. Dissociations between response types don't occur when subjects are asked to guess rather than report conscious experience. Moreover, when subjects are asked to guess, they do better, for all response types: there are more true positives and fewer false positives. So they

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<sup>7</sup> Here I'm indebted to discussions with Ned Block.

<sup>8</sup> Here I am indebted to Richard Perry and Chris Frith.

<sup>9</sup> Note that in this experiment subjects do not have to say "no"; they merely fail to say "yes". But Marcel has indicated that similar patterns of response and dissociation were obtained when subjects were required to respond negatively as well as positively (personal communication).

are not simply applying a laxer reporting criterion. "The accepted inference from this difference is that the Report condition is a genuine reflection of report of conscious contents" (1994, p. 86; 1993).<sup>10</sup>

Marcel interprets these results by distinguishing first-order phenomenal consciousness from second-order reflexive consciousness. On this view, second-order reflexive consciousness is disunified: one reflexive consciousness has access to a particular first-order phenomenal experience, while another reflexive consciousness does not. Phenomenal consciousness plus one reflexive consciousness belong to one center of consciousness, while the other reflexive consciousness belongs to another separate center of consciousness. But this latter must presumably have its own separate phenomenal consciousness, if we understand reflexive consciousness in terms of its access to some phenomenal consciousness—even if only consciousness of unrelieved darkness. So the split in consciousness must extend into phenomenal as well as reflexive consciousness. Perhaps various background experiences and intentions are duplicated in the two centers of consciousness.

Another interpretation of Marcel's results is in terms of partial unity. Suppose these subjects experience, simultaneously, both consciousness of a light and consciousness of unrelieved darkness, but that these experiences are not co-conscious. Nevertheless, both experiences are co-conscious, as in Trevarthen's case, with one unified set of background experiences and intentions: experiences of the sound of the click that indicates the trial is beginning, intentions to do what is needed to follow the experimenter's instructions, and so on.

These two interpretations are variants of our now-familiar options: partial unity vs. separate centers of consciousness. Again, we can ask: is this a distinction without a difference? Once again, we cannot distinguish between these hypotheses about the structure of consciousness purely subjectively, in terms of what it is like. Neuroanatomical isomorphism is a nonstarter here, since the same normal subjects are involved in the guessing and reporting modes, but the disunity only emerges in the reporting mode. And again here, both these interpretations neglect something really striking in these results: the apparent motor dependence of perceptual experience. Let us try to develop a view that does respond to this aspect of Marcel's results.

Marcel suggests that his results call into question the assumption that "[s]ince responses which are reports or descriptions are temporally and logically posterior to what they describe, they cannot influence what they describe" (1993). Similarly, I suggested earlier that Trevarthen's case brings into question the standard assumption that perceptual experience cannot depend directly on motor factors. Marcel's results bring this challenge into sharper focus. In Trevarthen's case, sensory inputs are constant across time periods while perceptual experience varies with motor intentions. However, we saw how changes in attention rather than intention might be directly responsible for the change in experience. By contrast, in Marcel's cases, one and the same stimulus-episode appears to evoke simultaneous but inconsistent experiences, corresponding to different but simultaneous means of reporting. It is hard to see how attention could account for this.

It may help to understand these results to consider the way a stimulus that would normally be consciously experienced can be masked from conscious perception in normal subjects by an immediately subsequent, consciously perceived stimulus (Marcel 1983a, b). Despite their

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<sup>10</sup> It would be interesting to consider the relationship of Marcel's results to the neuroanatomical ventral/dorsal distinction, though it is far from evident how that distinction might resolve the issues at stake here.

inaccessibility to consciousness and direct report, masked events have clear influence on the performance of various tasks. The information they provide is implicitly used; it interacts with conscious information. Masking by subsequent stimuli has been used by Dennett to argue for the temporal spread of the vehicles of perceptual contents. The timing of subpersonal vehicles of content need not match the timing of events as represented in such contents.

Perhaps subsequent motor intentions or actions, as well as subsequent experiences, can mask a prior stimulus. This might happen even when the intention or action indirectly responds to the very stimulus that is masked.<sup>11</sup> If so, that would suggest that temporally spread vehicles of perceptual experience can take a particular form, involving subpersonal feedback from motor processes. And why not? After all, there is no impenetrable barrier between sensory and motor processes in the brain.<sup>12</sup>

Is something like this happening in Marcel's cases? Consider first a trial requiring only a verbal report, which is the least accurate response type. Suppose the light goes on but no light is reported. Information about the stimulus may well be present even though not conscious, since we know that the light would have been more likely to be reported if a different type of report had been required. This suggests the motor-dependence of perceptual experience: that some kind of subpersonal feedback associated with the intention to respond in one way rather than another determines how reliably perceptual information reaches consciousness.<sup>13</sup>

Now consider a trial requiring three simultaneous speeded reports, of different response types. Suppose the light comes on and is reported by button-press and by blinking, but not verbally. In this situation, motor dependence seems to compromise the unity of consciousness. There is no way to distinguish time periods to avoid the disunity, since the different responses are called for simultaneously.

The subjects seem to be unaware of the inconsistency of their responses. This lack of awareness seems very odd, but perhaps it shouldn't surprise us: after all, we have found that there is nothing it is like to be disunified. Subjects appear to be unable, at the personal level, to monitor some of their intentions and actions when speeded reports are required--unable to relate, compare, integrate and reconcile them.

It is natural to think of this disunity of agency as a consequence of the causally prior disunity of consciousness. However, we can also speculate about whether the unity of consciousness might itself be motor-dependent. If the presence of perceptual information to consciousness, hence the content of perceptual consciousness, can be motor-dependent, why not the unity of consciousness? We have already allowed that subpersonal feedback from intended

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<sup>11</sup> For a relevant hemineglect case, see Bisiach et al 1985, 1989, discussed in Hurley 1998, pp. 202-203.

<sup>12</sup> It should not be supposed that this would involve backward causation! That will only seem to be the case if we confuse temporal properties in content with temporal properties of vehicles of content, or assume temporal atomism. See Dennett 1991a, Dennett and Kinsbourne 1992; Hurley 1998, essay 1.

<sup>13</sup> Recall here Marcel's interpretation in terms of phenomenal and reflexive consciousness. We could make a similar point about single response trials in those terms: information about the stimulus can be present to phenomenal consciousness, even on trials when verbal report is negative. But feedback from intended response type affects whether the information is accessible to reflexive consciousness, hence to report.

response type might determine the presence of information to consciousness. Could not the normal unity of consciousness also depend on a dynamic subpersonal process of calibrating various motor and sensory signals, including motor feedback from different response types? If so, the temporal window (at the subpersonal level) required for the unity of consciousness 'at a time' (at the personal level) would have to be wide enough to allow such subpersonal feedback to operate. The unified consciousness of even a momentary event could thus take some time. If this dynamic motor-dependent process were disabled, the effect might be disunity of consciousness.

Could this motor-dependence hypothesis about the unity of consciousness explain why allowing leisurely reporting avoids dissociation between response types in Marcel's simultaneous response trials? Does unity depend on feedback processes that take more time than speeded responses allow? If so, are the reconciling processes that delay permits personal-level, conscious, inferential processes, or subpersonal? Suppose the subject can be described at the personal level as engaging in deliberate practice at making consistent simultaneous reports under increasingly tight time constraints. Would this eventually yield noninferential unity of consciousness even for speeded responses? That could be seen as analogous to perceptual adaptation to inverting goggles, which often depends on long-term practice at activities while wearing the goggles that makes motor feedback available to the subject (see Hein 1980, p. 52; cf. Gyr et al 1979; Taylor 1962; Hurley 1998, essays 9, 10). I raised a related question arise about possible adaptive unification in commissurotomy. These speculative questions about how the unity of consciousness might be motor-dependent should in principle be open to experimental assessment.

It may be harder to see how the motor dependence hypothesis about unity might explain why asking subjects to guess rather than to report conscious experience avoids dissociation between response types in simultaneous response trials.<sup>14</sup> Subjects who are guessing nevertheless do so by intentionally acting in various ways: by blinking, pushing a button, or speaking. However, when they are guessing, the information that causes them to respond positively in these various ways does not provide a reason for what they do, the way it does when they report conscious experience. It is arguable that conscious information must be available as a reason for intentional action (Hurley 1998, essay 4). If so, then one speculative hypothesis is that avoiding dissociation among conscious states is more demanding than avoiding dissociation between unconscious states because the former but not the latter brings additional reasoning processes into play. Such reasoning or rational integration may require intentions to follow an inferential sequence ("if I do *this* because I see *that*, then I should also do *that*"). Perhaps such reasoning is more powerful than integration of unconscious information under response conditions that permit a sequence of motor intentions congruent with the relevant inferential sequences. However, it could be less efficient than integration of unconscious information under conditions that preempt congruence by making simultaneous demands on different motor intentions. This hypothesis would suggest that the unity of consciousness requires rational inferential integration as well as subpersonal integration.

Thus, a question for further work is: what role does such availability of information as a reason for acting have in the unity of consciousness? If the unity of consciousness is motor-dependent, should this be understood in subpersonal-level terms, personal-level terms, or both? I argue elsewhere that the correct answer is "both" (see Hurley 1998, part I).

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<sup>14</sup> Richard Perry has suggested in discussion a different possible account, in terms of a ceiling effect of accuracy in guessing: guessing may be accurate enough in all modes that there is no room for dissociation.

## 8. Concluding remarks on motor dependence

The motor dependence hypothesis about unity responds to the aspect of Marcel's and Trevarthen's cases that challenges standard assumptions. On this hypothesis, a unified consciousness is not a kind of interface sandwiched between input and output, the destination of perception and the origin of action. Rather, it may depend on a dynamic subpersonal system involving circular relations between sensory inputs and motor outputs, with multiple levels of feedback, both internal and external. Such a dynamic singularity in the field of causal flows, centered on but not strictly bounded by the organism, is a candidate for the subpersonal basis of the unity of consciousness. This is a functional rather than an neuroanatomical characterization. Thus, the objections to the neuroanatomical isomorphism view do not apply to this view: some of the causal loops that contribute to a dynamic singularity might well go external, as in the case of our hypothetical, externally integrated acallosal.

What are the implications of the motor dependence view for whether partial unity of consciousness is possible? It seems to be no accident that the same cases raise issues both about partial unity and about motor dependence. In the cases we've examined, the motor dependence view does not so much show us how partial unity might be objectively possible as show us how to dissolve the puzzles about partial unity.

In Trevarthen's case, we can avoid the puzzle about partial unity vs. separate centers of consciousness by accepting that perceptual experience can be motor-dependent even when sensory inputs are constant. If the motor intention changed at time  $t$ , we can say that before  $t$  experience had one motor-dependent content, and after  $t$  another, and at no time was there disunity. In Marcel's cases, by contrast, the different motor intentions are present simultaneously, so this way out is not available. So here, we are forced to confront the issue of whether there is any objective difference between partial unity and separate centers of consciousness. The motor dependence view here suggests how the contents and the unity of consciousness 'at a time' may depend on subpersonal feedback processes that spread through time, rather than on a static structure that is either whole or partial at a given moment. Relative to temporal units that are too small, in which these processes cannot play out, there may be no determinate structure of consciousness. In such cases, the distinction between partial unity and separate centers of consciousness would indeed be a distinction without a difference.

Finally, it is important to recognize that this view would be compatible with realism about consciousness. Realism about consciousness must respect the constraints imposed by whatever the real empirical nature of consciousness turns out to be.<sup>15</sup>

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