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A Split-Brain Perspective on Illusionism

Abstract: *The split-brain literature offers a unique perspective on theories of consciousness. Since both the left and right hemispheres of split-brain patients remain conscious following split-brain surgery, any theory that attempts to explain consciousness in neurotypical individuals must also be able to explain the dual consciousness of split-brain patients. This commentary examines illusionism — the theory that phenomenal properties are illusory — through the lens of the split-brain literature. Based on evidence that both hemispheres of split-brain patients are capable of introspection and both hemispheres can experience and maintain illusions, it is theoretically possible that phenomenal properties are illusions created by distorted introspection, in accordance with illusionism. However, in order to appropriately evaluate whether illusionism is a valid explanation of consciousness in split-brain patients, it is imperative that neural mechanisms are proposed that explain how introspection gives rise to illusory phenomenal properties.*

Any theory that attempts to relate conscious experiences to the brain must at some point account for the unique consciousness of a split-brain patient. Split-brain patients, who have had their corpora callosa severed as a treatment-of-last-resort for severe epilepsy, are strangely normal following surgery. They maintain meaningful conversation, move about in a coordinated fashion, exhibit appropriate desires and

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emotions, maintain social relationships, and many even hold a job. Zaidel (1994) writes, 'Their walk is coordinated, their stride is purposeful, they perform old unilateral and bimanual skills, converse fluently and to the point, remember long-term events occurring before surgery, are friendly, kind, generous, and thoughtful to the people they know, have a sense of humor, and so on down a whole gamut of what it takes to be human' (pp. 9–10).

Disconnecting the two hemispheres does not noticeably impair consciousness. Instead, it appears to *split* consciousness: there is ample evidence suggesting that the two hemispheres possess independent streams of consciousness following split-brain surgery (see Marinsek, Gazzaniga and Miller, 2016). Therefore, any theory that proposes mechanisms for consciousness in neurotypical individuals must also be able to explain the preserved consciousness in each hemisphere of a split-brain patient.

In this commentary, we will examine whether the theory of illusionism is compatible with the split-brain literature. Illusionism posits that the phenomenal properties of consciousness are an illusion produced by the limitations of introspection:

> Illusionists deny that experiences have phenomenal properties and focus on explaining why they seem to have them. They typically allow that we are introspectively aware of our sensory states but argue that this awareness is partial and distorted, leading us to misrepresent the states as having phenomenal properties. (Frankish, this issue, p. 14)

In order to determine whether illusionism can account for consciousness in split-brain patients, we will address the following three questions:

1. Does each hemisphere of a split-brain patient have phenomenal experiences?
2. Is each hemisphere of a split-brain patient capable of introspection?
3. Is there any evidence that each hemisphere of split-brain patient can create and maintain an illusion?

As we attempt to answer these questions, we may ascribe thoughts, intentions, and behaviours to the left and right hemispheres of split-brain patients. We do so out of convenience and not to anthropomorphize the hemispheres. When we refer to the disconnected left hemisphere, please note that it is more accurate to refer to the entire split-brain patient, minus the disconnected right hemisphere, and vice versa for the right hemisphere.

1. Do split-brain patients have phenomenal experiences?

In order to determine if illusionism holds for split-brain patients, we must first verify that split-brain patients experience the subjective feelings associated with phenomenal consciousness. Our aim is to determine whether split-brain patients experience the phenomenal properties that neurotypical individuals experience, regardless of whether those properties are real or illusory. Therefore, when we refer to 'phenomenal consciousness', we are referring to conscious experiences that either have phenomenal properties or simply appear to have them. According to Block (2005), phenomenal consciousness refers to the *content* of an experience: 'phenomenally conscious content is what differs between experiences as of red and green' (p. 46). Put a different way, Block also states, 'Phenomenal consciousness is experience; the phenomenally conscious aspect of a state is what it is like to be in that state' (1995, p. 227). Phenomenal consciousness differs from access consciousness, which refers to the accessibility of information for processing by cognitive modules or networks (Block, 2005). Access consciousness does not refer to the content of an experience, but rather its availability for use by different cognitive modules, such as those that support memory, decision making, reasoning, action, and so on.

There is little doubt that the left hemisphere is phenomenally conscious. Split-brain patients report that they feel no different following their surgeries. Since the neural machinery supporting language is lateralized to the left hemisphere, we can attribute patients' self-reports to the left hemisphere. Based on the verbal reports of the left hemisphere, there is no indication that the subjective consciousness of the left hemisphere is any different from the subjective consciousness of neurotypical individuals, and we can presume that the left hemisphere possesses both access consciousness and phenomenal consciousness.

Characterizing the conscious experience of the disconnected (and mute) right hemisphere is more challenging. Because the right hemisphere has an impoverished language system, we cannot rely on verbal introspective reports to determine that it is conscious. Instead, we must infer the conscious status of the right hemisphere based on its capabilities and behaviours in controlled experiments.

When we examine the behaviours and abilities of the disconnected right hemisphere, it is clear that it has access consciousness. Block

states that access conscious content is comprised of 'information about which is made available to the brain's "consumer" systems: systems of memory, perceptual categorization, reasoning, planning, evaluation of alternatives, decision-making, voluntary direction of attention, and more generally, rational control of action' (2005, p. 47). In controlled experiments, the right hemisphere is able to independently remember information (Phelps and Gazzaniga, 1992; Metcalfe, Funnell and Gazzaniga, 1995), categorize objects (Metcalfe, Funnell and Gazzaniga, 1995), make inferences about perceptual causality (Roser *et al.*, 2005), make predictions (Wolford, Miller and Gazzaniga, 2000), control attention voluntarily (Holtzman *et al.*, 1981), and initiate purposeful movement (reviewed in Gazzaniga, 2000). The fact that the right hemisphere's 'consumer' systems are functionally intact indicates that relevant information is accessible within the right hemisphere, and suggests that the disconnected right hemisphere meets the criteria for possessing access consciousness.

It is less certain whether the right hemisphere is *phenomenally* conscious, in the sense that it experiences phenomenal feelings. No split-brain studies to our knowledge have set out to determine whether or not the right hemisphere is phenomenally conscious, and it is unclear whether it is even possible to do so without relying on verbal or written self-report. We do know that the disconnected right hemisphere can distinguish between contents that have different phenomenal properties (to neurotypical individuals): it can distinguish between different colours (Wolford, Miller and Gazzaniga, 2000), different sounds (Musiek, Pinheiro and Wilson, 1980), and different touch sensations (Zaidel, 1998), for example. Although we cannot know for certain whether these different sensations are associated with different phenomenal feels, we also cannot know for certain that they are not. Block makes the argument that introspective self-reports are not necessary to verify phenomenal consciousness: 'you don't need reports about the subject's experiences to get good evidence about what the subject is experiencing: indications of what the subject takes to be in front of him will do just fine' (2005, p. 51). Based on the evidence that the right hemisphere has sensory experiences and meets the criteria for access consciousness, we can presume that it also has phenomenal consciousness even though it cannot describe the contents or subjective feelings of its experiences.

2. Are split-brain patients capable of introspection?

The second question we need to address is whether or not the disconnected hemispheres of split-brain patients are capable of introspection. According to illusionism, phenomenal feelings arise because introspection misrepresents sensory states. Frankish argues that — just like how our visual systems create the illusion that objects are coloured — our introspective systems may create the illusion that sensations have phenomenal feels:

> Sensory states have complex chemical and biological properties, representational content, and cognitive, motivational, and emotional effects. We can introspectively recognize these states when they occur in us, but introspection doesn't represent all their detail. Rather, it bundles it all together, representing it as a simple, intrinsic phenomenal feel. Applying the magic metaphor, we might say that introspection sees the complex sleight-of-hand performed by our sensory systems as a simple magical *effect*. (Frankish, this issue, p. 18)

In order for illusionism to explain the phenomenal consciousness of each hemisphere in a split-brain patient, there must be some evidence that the hemispheres are independently capable of introspection. The split-brain literature provides several examples of such evidence.

In 1977, LeDoux, Wilson and Gazzaniga conducted a series of experiments that assessed the introspective abilities of the left and right hemisphere of a split-brain patient (patient P.S.). In the first study, a word was presented to the patient's left or right hemisphere and the patient judged how good or bad the word was by pointing to a 7-point Likert scale, where 1 represented good and 7 represented bad. The left and right hemisphere reported similar ratings for a few of the words; for example, both the left and right hemispheres rated *car* and *money* as good (1) and *vomit* as somewhat bad (5). However, most of the hemispheres' ratings differed substantially. Six out of the twelve words were associated with at least a 4-point rating gap, with the right hemisphere almost always giving a more negative rating. For example, the left hemisphere rated the words *nice*, *mother*, *sex*, and *Paul* (the patient's own name) as good (1), but the right hemisphere rated these words as bad (6–7).

In a second study from the same series, LeDoux, Wilson and Gazzaniga (1977) presented a word to the left or right hemisphere and asked the patient to indicate how much he liked the word by pointing to one of five options, ranging from 'like very much' to 'dislike very much'. This time, the ratings of the left and right hemispheres were

quite consistent: the left and right hemispheres gave 12 of the 16 words the same rating, and the rating gaps of words with different ratings were generally much smaller than in experiment 1. Not only were the ratings consistent, they were also quite reasonable and did not appear to be random or meaningless. The left and right hemisphere reported that they 'very much liked' the words *home*, *church*, *mom*, *dad*, *Paul*, and *Fonz* (the TV character) and 'liked' the words *sex*, *school*, *police,* and *Liz* (the patient's girlfriend). The only word that received consistently poor ratings was *Nixon*, which the right hemisphere reported it 'disliked' and the left hemisphere reported it 'disliked very much'.

In the third experiment, the researchers presented a question to the right hemisphere and asked the split-brain patient to spell out his answer using Scrabble tiles. When asked 'Who are you?' the patient correctly spelled out PAUL. When asked who his favourite girl was, the patient spelled out LIZ, his girlfriend. When asked what his mood was, the right hemisphere spelled GOOD and then SILLY when asked again later. Finally, when asked what job he wanted, the patient spelled AUTOMOBILE RACE, even though the patient routinely said (via the left hemisphere) that he wanted to be a draftsman.

In another experiment, Sperry, Zaidel and Zaidel (1979) showed pictures to the left or right hemisphere of a different split-brain patient (L.B.) and asked him to give the picture a thumbs-up or a thumbs-down based on how he felt about it. The ratings of the right hemisphere were identical to the left hemisphere's verbal reports and were again quite reasonable: 'LB had responded with "thumbs-down" evaluations for Castro, Hitler, overweight women in swim suits, and a war scene. Intermixed with these and other responses, "thumbs-up" signals were obtained for Churchill, Johnny Carson, pretty girls, scenes from ballet and modern dance and a horizontal neutral thumb signal for Nixon' (*ibid.*, p. 163).

Taken together, these experiments demonstrate two important points. First, the left and right hemispheres are both capable of accessing their mood, desires, feelings, and opinions about things, people, and themselves. It is important to note that it is possible that the right hemisphere's responses reflect conditioned associations rather than purposeful introspection. That is, it is possible, for example, that the right hemisphere gave Hitler a thumbs-down because it has many low-level, negative associations with Hitler and not because it introspectively accessed its feelings when Hitler's picture was presented. However, the right hemisphere's ability to

report its opinions and desires by arranging Scrabble tiles, which have an infinite number of possible arrangements, suggests that the reports of the right hemisphere extend beyond simple conditioned associations and instead reflect true introspection. Second, these experiments demonstrate that the opinions of the left and right hemisphere are independent — sometimes they agree and sometimes they do not. This provides further evidence that the conscious experiences of the left and right hemispheres are distinct and independent, and illusionism (or any other theory of consciousness) must be able to account for both.

3. Do split-brain patients experience illusions?

Frankish makes the argument that phenomenal feelings are a special type of illusion, similar to the illusion of colour or the illusion of continuous motion in film or cartoons. What separates phenomenal feelings from other types of illusions is that they are inherently subjective and can only be observed from one vantage point (that is, via introspection). We cannot directly determine whether each hemisphere is capable of creating the illusion of phenomenal feelings, but we can explore whether the hemispheres are capable of creating and maintaining other sorts of illusions. If we find evidence that both hemispheres of a split-brain patient experience a variety of illusions, it may be more likely that the hemispheres are capable of creating the illusion of phenomenal feelings in accordance with illusionism.

Evidence suggests that both the left and right hemispheres of split-brain patients experience perceptual illusions. For example, both hemispheres have been shown to perceive motion when there is none (Corballis *et al.*, 2004) and perceive contours where there are none (Corballis *et al.*, 1999), and the right hemisphere has been shown to judge that the trajectories of two colliding shapes are causal (Roser *et al.*, 2005).

There is also evidence that the left hemisphere experiences an illusion of control. The illusion of control refers to instances when the left hemisphere mistakenly claims ownership of an action that was actually initiated and carried out by the right hemisphere. Marinsek, Gazzaniga and Miller (2016) describe a case where the command to stand up was presented to the right hemisphere of a split-brain patient. After the patient stood, the experimenters asked him why he stood up. Even though the left hemisphere was not given the command to stand, the patient (speaking with his left hemisphere) explained that he stood

up because he was thirsty and wanted to get a drink. The left hemisphere not only claimed ownership of the act, but it also ascribed an intention to it. By doing so, the left hemisphere maintained the illusion of control over the body. In a similar example, the word 'smile' was presented to the right hemisphere and the word 'face' was presented to the left hemisphere and the patient was asked to draw what he saw. The patient drew a smiley face and the experimenter asked him why he did so. Again, the patient's left hemisphere offered an explanation that maintained the illusion of control, saying 'What do you want, a sad face? Who wants a sad face around?' (Gazzaniga, 2013, p. 14).

Closely related to the illusion of control is the illusion of unity, and it is perhaps the most striking feature of split-brain patients. As we have said, split-brain patients do not *feel* disconnected or disunified following their surgeries. The patients feel unified even though they have split brains and, by all indications, split minds (see Marinsek, Gazzaniga and Miller, 2016). The continuation of the patients' subjective feelings of unity is evident in the responses of some split-brain patients during testing. For example, Sperry, Zaidel and Zaidel (1979) asked patient L.B.'s right hemisphere to give a thumbs-up or a thumbs-down to various pictures, and at some point during the testing the right hemisphere gave a thumbs-down to three pictures in a row. When the experimenter questioned the third thumbs-down, the patient's left hemisphere remarked, 'Guess I'm antisocial' (*ibid.*, p. 160). Not only did the left hemisphere assume responsibility for the right hemisphere's negative responding, but it implied that the right hemisphere's behaviour was reflective of its own self-identity, and not that of some other entity. That is, the left hemisphere didn't say, 'my right brain is acting antisocial' or 'I wasn't the one who gave the thumbs-down', as might be expected if there was no illusion of unity.

In some cases, the left and right hemispheres have conflicting intentions and the left and right hands attempt to carry out different actions. Interestingly, when conflict arises, the illusion of control breaks down but the illusion of unity still holds. For example, one of the first split-brain patients reported: 'The muscles of my left side do not coordinate very well with those of the rest of my body. For instance, I find myself trying to open a door with the right hand and at the same time trying to push it shut with the left; putting my dress on with the right and pulling it off with the left' (Van Wagenen and Herren, 1940, p. 756). In this example, the patient (speaking with her left hemisphere) suggested that she lacks full control of her left hand (which is largely controlled by the right hemisphere), but she

attributed her lack of coordination to the muscles in her left side and not to some other mind or intentional agent. The split-brain literature contains many more instances where patients indicate that they are not in control of their left hands, but the patients never give any indication that they possess two duelling minds or that their conscious experience is fragmented or split in any way (Zaidel, 1994).

The illusions of control and unity may be maintained by the left hemisphere interpreter, a cognitive module rooted in the left hemisphere that creates causal explanations (Gazzaniga, 1989). The effects of the interpreter are apparent when the left hemisphere is asked to explain the right hemisphere's behaviour. Even though the left hemisphere does not have access to the information presented to the right hemisphere, or the thoughts, intentions, and desires of the right hemisphere, the interpreter will offer an explanation for the right hemisphere's behaviour. The explanations of the interpreter are often plausible — for example, the patient's explanation that he stood up to get a drink sounds completely rational if you did not know that the right hemisphere was given the command to stand. More importantly, the interpreter's rationalizations help maintain the illusions of unity and control. As Gazzaniga writes:

> The interpreter is driven to generate explanations and hypotheses regardless of circumstances. The left hemisphere of split-brain patients does not hesitate to offer explanations for behaviours, which are generated by the right hemisphere. In neurologically intact individuals, the interpreter does not hesitate to generate spurious explanations for sympathetic arousal. In these ways, the left hemisphere interpreter may generate a feeling in all of us that we are integrated and unified. (2000, p. 1319)

The effects of the interpreter are more visible in split-brain patients where we know there is a lack of control and unity, but it likely contributes to the subjective feelings of control and unity in neurotypical individuals as well.

4. Conclusion

One major limitation of the theory of illusionism is that it does not offer any mechanisms for how the illusion of phenomenal feelings works. As anyone who has seen a magic trick knows, it's quite easy to say that the trick is an illusion and not the result of magical forces. It is much, much harder to explain how the illusion was created. Illusionism can be a useful theory if mechanisms are put forth that

explain how the brain creates an illusion of phenomenal feelings. When mechanisms are proposed, the split-brain literature will be an important testing ground for determining whether the candidate mechanisms can account for the split consciousness of split-brain patients.

One thing the split-brain literature tells us is that phenomenal consciousness may not be the product of one grand illusion. Instead, phenomenal consciousness may be the result of multiple 'modular illusions'. That is, different phenomenal feelings may arise from the limitations or distortions of different cognitive modules or networks. This idea is echoed by Block (2005) who suggests that phenomenal experiences are produced by local neural processing, such that recurrent neural activity in area MT/V5 creates the phenomenal feeling of motion and recurrent neural activity in the fusiform face area creates the experience of seeing a face. The left and right hemispheres of a split-brain patient may have different phenomenally conscious experiences because they house different specialized neural networks. It may be possible that the right hemisphere has reduced phenomenal feelings for verbal representations and the left hemisphere has reduced phenomenal feelings for visual or spatial representations. If this is the case, phenomenal consciousness can be fragmented. Illusionism therefore may not have to account for one grand illusion, but for many 'modular illusions' that each have their own neural mechanisms.

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