

Is Vision for Action Unconscious?*

Wayne Wu

(Forthcoming in the *Journal of Philosophy* who holds the copyright).

The primate cortical visual system is branched, with two streams emerging from early visual areas: a dorsal stream that extends into parietal cortex and a ventral stream that extends into temporal cortex. This anatomical division underlies a functional one, initially conceptualized by Leslie Ungerleider and Mortimer Mishkin who characterized the dorsal stream as a *where* stream for spatial vision and the ventral stream as a *what* stream for object vision.¹ This conception was modified by David Milner and Melvyn Goodale who focused on the output of each stream, characterizing the ventral stream as supporting *vision for perception*, so informing decision making, planning, memory and thought, broadly conceptual activities, and the dorsal stream as supporting *vision for action*, processing precise spatial information to inform accurate on-line motor movement.² Interestingly, they argued that vision supported by the dorsal stream is unconscious: “[our view is] committed to the claim that dorsally mediated coding of objects for visually guided action does not contribute to how those objects or scenes are represented in conscious visual experience.”³ Riffing on the philosophical notion of zombies as creatures devoid of phenomenal consciousness, visually guided motor actions are *zombie actions*. Zombie actions are guided by unconscious subject level visual states. I have previously argued in support of this position.⁴

Milner and Goodale’s account of the two visual streams has, to put it mildly, had a tremendous influence on theories of consciousness (talk of the two visual stream hypothesis will refer to their account). Andy Clark deployed the hypothesis to argue against *Experienced Based Control*:

*I am grateful to a referee for this journal for helpful comments. The content of this paper was presented in different forms at The Association for the Scientific Study of Consciousness in Western Ontario, the Keck Neuroscience Department at Claremont McKenna, Pitzer and Scripps Colleges, the departments of philosophy at Carnegie Mellon University, Southern Methodist University, and Washington University, St. Louis. Thanks to the participants of those events for their comments. I am grateful to Ian Phillips for comments on an earlier version of this manuscript.

¹ Leslie G Ungerleider and Mortimer Mishkin, “Two Cortical Visual Systems,” in David J. Ingle, Melvyn A. Goodale, & Richard J. W. Mansfield, eds., *Analysis of Visual Behaviour* (Cambridge: MIT Press, 1982), pp. 549-86.

² David A. Milner and Melvyn A. Goodale, *The Visual Brain in Action*, 2nd ed., (Oxford: Oxford University Press, 2006).

³ Robert T. Foley, Robert L. Whitwell, and Melvyn A. Goodale, “The Two-Visual-Systems Hypothesis and the Perspectival Features of Visual Experience,” *Consciousness and Cognition* XXXV (September, 2015) pp. 225–33 at p. 228.

⁴ Wayne Wu, “The Case for Zombie Agency,” *Mind* CXXII, 485 (2013): 217–230. See also Joshua Shepherd, “Conscious Action/Zombie Action,” *Noûs* L, 2 (2016): 419–44. Refuting one’s previous view is painful, but given that I have argued for zombie action and here, for its negation, I suppose anyone interested in vision and action could be satisfied by something I have written.

The contents of conscious visual experience, are typically active in the control and guidance of our fine-tuned, real-time engagements with the surrounding three-dimensional world.⁵

Clark's influential article gave rise to further debates with Christopher Mole and Morgan Wallhagen in opposition.⁶ I argued for expanding Clark's perspective to cover ordinary human action in neurologically intact individuals.⁷ There has been further debate about how to understand the two visual stream hypothesis in relation to agency and awareness.⁸ In short, the empirical theory of cortical vision has had a substantial impact on theories of visual consciousness and its role in human agency by downgrading visual experience's role in the control of action.

I argue here against the empirical case for zombie action. Introspection provides crucial data for that case, but it cannot provide reliable data needed to divide the relevant theoretical possibilities. In arguing against introspection, I do not proceed from a general skepticism about it.⁹ Rather, I draw on the functional anatomy of the visual system to cast doubt on the relevance of introspection in this context. After noting recent empirical developments about primate vision (section 1), I present the empirical argument that the dorsal stream is unconscious (section 2). This argument assumes introspective reliability. To assess whether introspection is reliable, I draw on common philosophical accounts of introspection that make central a role for attention. Attention allows us to ground introspective judgment on the experience it is about. I argue (1) that on the two visual stream hypothesis, introspecting visual experience is realized in the ventral stream as part of vision for perception (section 3). This means (2) that introspective reports provide information about the ventral and not the dorsal stream. As such, (3) they cannot be used to draw conclusions about the dorsal stream as assumed by the empirical argument (section 4). Therefore, the empirical argument for unconscious vision is unsound. Support then comes from philosophical arguments for unconscious vision that impose a narrow access condition on phenomenal consciousness. In the final section, I suggest that this standard assumption begs the question regarding the relation between consciousness and agency, specifically in respect of an intentional access condition on consciousness. I argue that this condition provides an important option for understanding the relation between consciousness and access, and that we should consider anew such possibilities for how agency and consciousness are related.

⁵ Andy Clark, "Visual Experience and Motor Action: Are the Bonds Too Tight?" *Philosophical Review* CX, 4 (2001): 495–520, at p. 496.

⁶ Christopher Mole, "Illusions, Demonstratives and the Zombie Action Hypothesis," *Mind* CXVIII, 472: 995–1011. Morgan Wallhagen, "Consciousness and Action: Does Cognitive Science Support (Mild) Epiphenomenalism?" *The British Journal for the Philosophy of Science* LVIII, 3 (2007): 539–6.

⁷ Wu, "The Case for Zombie Agency" *op. cit.* For a response, see Christopher Mole, "Embodied Demonstratives: A Reply to Wu," *Mind* CXXII, 485 (2013): 231–39.

⁸ Robert Briscoe and John Schwenkler, "Conscious Vision in Action," *Cognitive Science* XXXIX, 7 (2015): 1435–67. See also Wayne Wu, "Against Division: Consciousness, Information and the Visual Streams." *Mind and Language* XXIX, 4 (2014): 383–406.

⁹ As Eric Schwitzgebel, *Perplexities of Consciousness* (Cambridge, MA: MIT Press, 2011).

1. Parcellation of the Dorsal Stream: A Brief Update

The dorsal stream can be subdivided. Dwight Kravitz et al. identify three substreams within the dorsal stream: (a) a *parieto-prefrontal* pathway tied to spatial working memory and eye movements; (b) a *parieto-premotor* pathway tied to the guidance of motor movements and (c) a *parieto-medial temporal* pathway tied to the medial temporal lobe including the hippocampus.¹⁰ Given their role in memory among other outputs, the parieto-prefrontal and parieto-medial temporal pathways can be construed as “for perception” in Milner and Goodale’s sense.

In discussion with a number of neuroscientists of vision, I have been struck by the fact that many of them do not see the dorsal stream to be unconscious, particularly those who work in monkey electrophysiology. As one eminent neuroscientist noted to me: neurologists would be surprised to hear that parietal lesions do not affect visual experience. In their original parcellation of primate vision, Ungerleider and Mishkin cited evidence of focal parietal lesions as affecting perception.¹¹ Recent evidence has suggested that posterior regions of the dorsal stream are involved in vision for perception by informing visual judgments regarding objects. In macaque monkeys, microstimulation of dorsal stream area CIP (caudal intraparietal area) activates regions in the ventral stream while inactivation of CIP affects judgments of depth.¹² Similarly, behavioral work suggests that posterior areas of the dorsal stream contribute to perceptual judgment.¹³

For our purposes, these developments, while potentially narrowing the area of unconscious dorsal visual processing, leave the basic idea intact: there is unconscious dorsal stream visual processing tied to the control of motor actions, say processing in the parieto-premotor pathway. This leaves Clark’s original claim untouched: much of everyday visuomotor action is zombie action.

2. Empirical Arguments that the Dorsal Stream is Unconscious

The primary *empirical argument for unconscious vision* is driven by a conflict between two behavioral data points: (A) the subject reliably visually guides behavior to a target V yet (B) the subject denies seeing V. If we think of (A) as providing an objective measure, for example

¹⁰ Dwight J. Kravitz, Kadharbatcha S. Saleem, Chris I. Baker, and Mortimer Mishkin, “A New Neural Framework for Visuospatial Processing,” *Nature Reviews. Neuroscience*, XII, 4 (2011): 217–30.

¹¹ For a later statement, see Leslie G. Ungerleider and James V. Haxby, “‘What’ and ‘Where’ in the Human Brain,” *Current Opinion in Neurobiology*, IV, 2 (1994): 157–65.

¹² Ilse C. Van Dromme, Elsie Premereur, Bram-Ernst Verhoef, Wim Vanduffel, and Peter Janssen, “Posterior Parietal Cortex Drives Inferotemporal Activations During Three-Dimensional Object Vision” *PLOS Biology*, XIV, 4 (2016): e1002445.

¹³ For reviews see Erez Freud, David C. Plaut, and Marlene Behrmann, “‘What’ Is Happening in the Dorsal Visual Pathway,” *Trends in Cognitive Sciences*, XX, 10 (2016): 773–84 and Gennady Erlikhman, Gideon P. Caplovitz, Gennadiy Gurariy, Jared Medina, and Jacqueline C. Snow, “Towards a Unified Perspective of Object Shape and Motion Processing in Human Dorsal Cortex.” *Consciousness and Cognition*, LXIV (September, 2018): 106–20.

percent correct performance in an observable task, and (B) as relying on a subjective measure, namely introspective report of one's experience, then the empirical argument for unconscious vision runs as follows:

1. Objective measure: Subject S shows reliable visually guided behavior to V.
2. Subjective measure: Subject S denies seeing V.
3. If (1) is reliable, we conclude that the subject sees V.
4. If (2) is reliable, we conclude that the subject does not see V.
5. (1) is reliable in the relevant context.
6. (2) is reliable (in the relevant context).
7. By (1)-(6): the evidence supports the subject's simultaneously seeing and not seeing V.

To resolve the conflict in (7):

8. Best explanation: (2) demonstrates absence of consciousness, (1) demonstrates presence of seeing, so together, they implicate a case of unconscious seeing.

That is, we have subject-level visual episodes that lack phenomenal consciousness. This argument form has been deployed drawing on the cases of blindsight and of the visual agnostic patient DF.

The second premise draws on the subject's introspective reports and the fourth assumes the reliability of those reports. The subjective measure is needed to address the issue of consciousness directly. Subjects' introspective judgments that they do not see are routinely treated as authoritative, yet we should not simply assume that introspection in this context is reliable. For example, the subjects at issue have suffered brain lesions. Neuropsychology never simply assumes that cognitive capacities remain intact in light of brain damage. In studies with neuropsychological patients, a battery of tests are applied to ascertain reliable cognitive and perceptual capacity, say in language processing, perception, attention and memory. Unfortunately, we have no analogous test for introspective reliability. This should give us pause in simply accepting introspective measures, for introspective capacity could be affected by brain lesions.

Data regarding the patient DF allows us to run the empirical argument for unconscious vision. DF has ventral stream damage in the lateral occipital area (area LO) which is functionally tied to processing form. Though she has preserved color and texture discrimination, DF is unable to detect or discriminate basic aspects of form.¹⁴ In a striking experiment, DF was asked to indicate the orientation of a vertical slot. This is a ventral stream task in that it involves using visual experience to inform report, a conceptual task. In this case, DF uses her hands to report a specific orientation and her performance accuracy is at chance. She also emphasizes that she cannot see the orientation. This provides the data for premise 2. Strikingly, if DF is asked to post an item through the slot, a dorsal stream task, her accuracy is essentially equivalent to that of neurologically intact controls. DF is reliable in this posting task, and the result provides the data for premise 1. The conclusion then is that the visual state that guides DF's motor movement is unconscious. Since vision for action is served by the dorsal stream, DF's dorsal stream is unconscious.

¹⁴ David A. Milner and Melvyn A. Goodale, *The Visual Brain in Action*, *op. cit.*

We can strengthen the evidential basis for zombie action by appeal to the larger set of blindsight subjects with preserved motor capacity. It is now held that blindsight subjects see unconsciously. A number of them demonstrate reliable motor behavior towards objects that they deny seeing.¹⁵ Running the empirical argument from these cases, we conclude that motor actions in blindsight are guided by unconscious vision. Since such actions are dorsal stream mediated, the dorsal stream substantiates unconscious vision.

Introspection is a discrimination and detection capacity, so one can introspectively detect conscious states and discriminate their phenomenal features. A discrimination and detection capacity is *positively* reliable if it increases the likelihood above chance that judgments based on it regarding the item discriminated and detected are correct. We should not, however, assume that a detection and discrimination capacity is reliable in every arbitrary context. For example, perception, a paradigm discrimination/detection capacity, is not reliable across all contexts. This is partly due to internal and external noise. It can also be due to the failure of certain necessary conditions for reliability. If a perceptual judgment is based on experience in a context in which perceptual experience is generally unreliable, then the judgment is less likely to be true, perhaps a guess (chance performance), or even consistently false (*negatively* reliable; consider perceptual judgments based on hallucination). Perception scientists often design experiments in contexts where perception is reliable and avoid unreliable contexts, say when they decide on appropriate test stimuli or when they determine presentation times. Deployments of introspection should be similarly sensitive to whether the context of deployment will yield reliable data.

To generate usable data, the deployment of discrimination and detection capacities must occur under reliable conditions. These conditions will vary from context to context. If noise and other contextual conditions modulate reliability of brain-based detection capacities like perception, they also challenge other brain-based detection capacities like introspection. The infallibility of introspection cannot be assumed. The fact that introspection is fallible points to its context varying reliability. Accordingly, we must ask of any introspective data whether it was generated in a reliable context. If we can show that introspective data is not reliable, then we should not use it.

Unlike perceptual judgment where stimulus presentation can be tightly controlled and perceptual reports assessed for accuracy, there is no corresponding method for assessing introspective accuracy. This makes it difficult to meet the reliability condition for use of introspective data. How might we then assess introspective reliability? I shall not address the general question but focus on the specific case of assessing introspection in arguments for unconscious vision in action.¹⁶ Introspection is not reliable regarding dorsal stream vision.

¹⁵ Beatrice de Gelder, Marco Tamietto, Geert van Boxtel, Rainer Goebel, Arash Sahraie, Jan van den Stock, Bernard M. C. Stienen, Lawrence Weiskrantz, and Alan Pegna, "Intact Navigation Skills after Bilateral Loss of Striate Cortex," *Current Biology*, XVIII, 24 (2008): R1128–29. See also Emily K. Prentiss, Colleen L. Schneider, Zoë R. Williams, Bogachan Sahin, and Bradford Z. Mahon, "Spontaneous In-Flight Accommodation of Hand Orientation to Unseen Grasp Targets: A Case of Action Blindsight," *Cognitive Neuropsychology*, XXXIV, 7 (2018): 343–51.

¹⁶ Some of the issues regarding introspective reliability will be discussed in my book on mental action, *Movements of the Mind*, in preparation.

3. Attention and Introspection

What does introspection of visual consciousness involve? The question asks for a psychological model of introspection of visual consciousness, yet we lack a detailed model. To move in this direction, I deploy an insight from philosophers that ties introspection to attention. For example, Brie Gertler writes:

By focusing your attention on the phenomenal quality of [an experience], you can come to know something about your current experience. Philosophers generally agree on this much.¹⁷

Philosophers conceive of introspective attention as an internally directed capacity that can be turned towards mental states. Lycan suggests that this is in fact how introspecting seems:

When we attend to our own mental states, it feels like that is just what we are doing: focusing our internal attention on something that is there for us to discern.¹⁸

Janet Levin ties attention to discrimination:

If I'm having more than one experience at a time...then I can denote distinct neural-particulars, respectively, as "this," "that," and so on, as long as I can discriminate among these experiences and successively direct my introspective attention to them at that time.¹⁹

There are many others who endorse a similar picture. Strikingly, while these philosophers often diverge in how they think about the metaphysics of consciousness, they converge on a central role for attention in informing introspective judgments about consciousness. Such introspective attention can directly target conscious perceptual states so as to inform judgments about those states. As the spotlight is a standard metaphor for visual attention, I'll call this picture of introspective attention the *inner spotlight model*.

In contrast to Lycan's claim that introspective attention seems to be directed inward, Gilbert Harman noted:

¹⁷ Brie Gertler, "Renewed Acquaintance," in *Introspection and Consciousness*, Declan Smithies and Daniel Stoljar eds., (New York: Oxford University Press, 2012), pp. 93–128, at p. 93.

¹⁸ William G. Lycan, "Perspectival Representation and the Knowledge Argument," in *Consciousness: New Philosophical Essays*, Quentin Smith and Aleksander Jokic, eds., (Oxford: Oxford University Press, 2004), pp. 384–95.

¹⁹ Janet Levin, "What Is a Phenomenal Concept?" in *Phenomenal Concepts and Phenomenal Knowledge: New Essays on Consciousness and Physicalism*, Torin Alter and Sven Walter, eds. (Oxford University Press, 2006), pp. 87-110, at p. 88.

Look at a tree and try to turn your attention to intrinsic features of your visual experience. I predict you will find that the only features there to turn your attention to will be features of the presented tree.²⁰

Perhaps Harman means that introspective attention is, paradoxically, just perceptual attention. The seeming paradox can be alleviated if we understand introspective attention as referring not to an inwardly directed form of attention but a form of attention whose function is to ground an inward form of judgment, an introspective judgment. Introspective attention is whatever form of attention serves introspective judgment. Harman's point resonates with an account of introspection suggested by Gareth Evans:

[A] subject can gain knowledge about his internal informational states [e.g. perceptual experience] in a very simple way: by re-using precisely those skills of conceptualization that he uses to make judgments about the world. Here is how he can do it. He goes through exactly the same procedure as he would go through if he were trying to make the judgment about how it is at this place now...he may prefix this result with the operator "It seems as though..."²¹

We can amend this. A subject in a position to perceptually judge that something is an F can redeploy this conceptual ability by going through the procedure of making that judgment but prefix the result with the operator, "I see that/I see an ___." For the cases we shall discuss, we can move from a perceptual judgment that there is no F to the introspective judgment I do *not* see an F. Thus, when looking for one's keys on a cluttered table, we visually search for them with attention. Our judgment that the keys are not there is founded on this detection activity. If we can report that the keys are not present, we can also report not seeing the keys.²²

Perceptual judgments about specific items require perceptual attention to those items. That is the function of selective attention. Consider the standard case where we make a visual judgment about some visible property P instantiated by an object. This object instantiates a number of visible properties, but our judgment is about only one property. That our thought is selective in being about P rather than other properties is not happenstance. Rather, the selectivity

²⁰ Gilbert Harman, "The Intrinsic Quality of Experience," in *Philosophical Perspectives: Action Theory and Philosophy of Mind*, IV, (1990): 31-52, at p. 39.

²¹ Gareth Evans, *The Varieties of Reference*, (Oxford: Oxford University Press, 1982), at pp. 227-8.

²² Moving from the claim that there is an F to the claim that I see an F is simpler than moving from there is not an F to I do not see an F (note the scope of the negation). When DF introspects the absence of a visual awareness of form and orientation which she reports by saying that she does not see those features, a natural model of introspective attention's informing judgment analogizes to visual search. Introspective attention must search the "visual phenomenal manifold" to ascertain that a certain visual phenomenology is present or missing. This would be a more complicated psychological task. The point is that the process eventuating in a judgment that one does not see F is likely to be more complex than talk of "noting an absence" suggests. That said, both models of introspection can agree that introspection of the absence of something in the phenomenal field requires introspective detection by attention. This requires that conditions for reliable attention are met. That suffices for our current purposes.

of the resulting judgment is explained by the fact that we visually attend to the relevant property (what psychologists call *feature* attention). Without visual attention to a target, we would not be able to form vision-based judgments about that target.

This claim has substantial empirical support. Consider the manipulation of attention in the inattentional blindness, change blindness, and attentional blink paradigms. Each of these demonstrate that (a) if a target is presented while attention is directed away from it as in inattentional blindness,²³ (b) if the target (a change) is presented under conditions of a mask that disrupts visual integration over time,²⁴ or (c) if the target follows too closely in time after attention has been directed to an earlier item,²⁵ subjects do not notice and hence are unaware of the target. If one thinks that forming a perceptual judgment about a target X requires noticing and being aware of it, then these attentional manipulations give evidence to the necessity of attention to X in order for a subject to respond to X and a fortiori to form a judgment about it. In these experiments, subjects fail to report the target and deny that there is such a target. Inattention to X leads to failure of awareness of it. If so, one can hardly form a judgment about it without further information. Accordingly, when Evans emphasizes the redeployment of capacities needed for perceptual judgment for reuse in introspection, this entails that attention as deployed in perceptual judgment is reused in introspection.

Despite their differences, the two accounts of introspection we have been discussing converge on attention as central to explaining the selectivity of introspective judgment. Crucially, both theories, when conjoined with the two visual stream hypothesis, map introspective processes to the ventral stream. Begin with the Evansian account. Perceptual judgment is a ventral stream mediated activity since it requires vision for perception, namely vision in the service of conceptual response. There is ample evidence for selective attentional effects in the ventral stream. For example, attentional selection is demonstrated in monkey electrophysiology during goal-directed tasks where neurons in area V4 at the base of the ventral stream and inferotemporal cortex later in the stream contract their receptive fields around task relevant targets.²⁶ Thus, in visually guided judgment, a conscious visual state that represents

²³ Daniel J. Simons and Christopher F. Chabris, “Gorillas in Our Midst: Sustained Inattentional Blindness for Dynamic Events,” *Perception* XXVIII, 9 (1999): 1059–74. See also Arien Mack and Irvin Rock, *Inattentional Blindness*, (Cambridge, MA: MIT Press, 1998).

²⁴ Melinda S. Jensen, Richard Yao, Whitney N. Street, and Daniel J. Simons, “Change Blindness and Inattentional Blindness,” *Wiley Interdisciplinary Reviews: Cognitive Science*, II, 5 (2011): 529–46.

²⁵ Paul E. Dux, and René Marois, “The Attentional Blink: A Review of Data and Theory,” *Attention, Perception, & Psychophysics* VXXI, 8 (2009): 1683–1700.

²⁶ Leonardo Chelazzi, John Duncan, Earl K. Miller, and Robert Desimone, “Responses of Neurons in Inferior Temporal Cortex during Memory-Guided Visual Search,” *Journal of Neurophysiology*, LXXX, 6 (1998): 2918–40 and Leonardo Chelazzi, L, Earl K. Miller, John Duncan, and Robert Desimone, “Responses of Neurons in Macaque Area V4 during Memory-Guided Visual Search,” *Cerebral Cortex*, XI, 8 (2001): 761–72. For discussion of computational models that link a subject’s intention to task-relevant neural selection in the ventral stream, see Wayne Wu, *Attention*, (Abingdon, UK: Routledge, 2014) and Wayne Wu, “Shaking Up the Mind’s Ground Floor: The Cognitive Penetration of Visual Attention,” *The Journal of Philosophy*, XCIV, 1 (2017): 5-32.

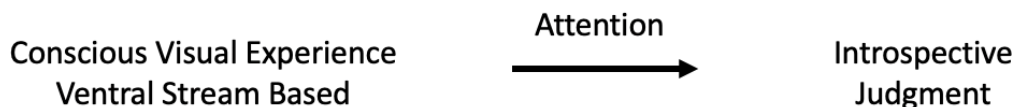
some target X forms the basis for a visual based judgment about X given that the subject visually attends to X.

Now deploy Evans' redeployment hypothesis: visual attention in respect of the visual experience of X informs not just a perceptual judgment about X but an introspective judgment that one sees X. Since introspective judgment is a conceptual response that is guided by the visual experience in question, it is a ventral stream mediated process reliant on attentional selection in the ventral stream. Evans' redeployment hypothesis thus implicates the reuse of the ventral stream processes that inform perceptual judgment to inform an introspective judgment.

The mapping of the inner spotlight account is less straightforward since it does not engage with empirical work. That said, attention as an inner spotlight functions to link the visual experience to an introspective judgment about it, and this requires an information link between experience and judgment. After all, one directly introspects an experience to read-off its phenomenal properties. Once this is acknowledged, inner spotlight views converge on the empirical upshot of the Evansian proposal. For how might the inner spotlight link a visual experience to judgment? The two visual stream account identifies the ventral stream as the core neural basis for visual experience, and it holds that information processing needed for informing conceptual response in vision for perception goes through information processing in the ventral stream. Accordingly, whatever the inner spotlight is, its attentional influence must also go through the information processing of the ventral stream so that a specific visual experience informs an introspective judgment about it. Thus, to generate an introspective report about a visual experience, introspection must involve vision for perception.

Both accounts of introspection then share an assumption about attention as expressed in the following informational structure:

Figure 1



The arrow indicates that the information link set up between the visual state and the judgment about it is due to attention. This link allows us to put flesh on the bones of Evans' idea that introspective judgment, in his sense of redeployment, can be intelligibly reliable. For where perceptual judgment is reliable, this depends on an informative information link between the

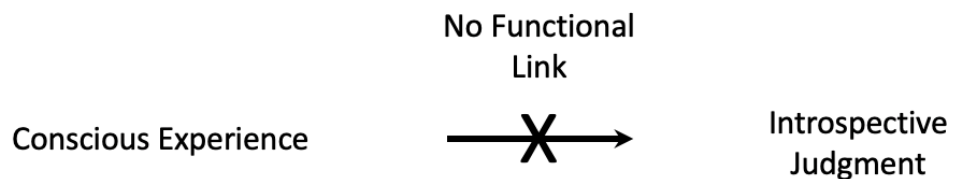
ventral stream based visual experience of the item judged, say an object that is F, and the application of the observational concept F in the judgment. A redeployment of that reliable link to form the introspective judgment that one sees an F suggests that such judgments will be reliable since they will be based on the ventral stream mediated experience of actually seeing an F. Accordingly, *introspection of visual experience is grounded in attentional processes that link ventral stream mediated experience to conceptual capacities deployed in judgement*. We have thus given introspection a biological grounding on the basis of the two visual stream hypothesis.

This biological account of introspection of visual experience assumes an informational condition. The judgments in question are grounded precisely because there is an information link between judgment and experience. It is necessary for the judgments to be reliable that they are based on some information link to what the judgment is of. Otherwise, such judgments are effectively guesses. Thus, if I have no perceptual or other access to some object behind me, say access to your testimony or my memory of it, I am in no position to render reliable judgments regarding it. My guesses do not support dividing among epistemic possibilities regarding that object.

This applies to phenomenal consciousness. Indeed, this necessary condition is invoked by Michael Cohen and Daniel Dennett in their *perfect experiment* against Ned Block's claim that the phenomenal overflows access.²⁷ Cohen and Dennett imagine with overflow theorists that early visual areas might generate a conscious visual state even if all the circuits that enable access to that state are eliminated. They suggest, however, that without access, no evidence regarding conscious vision is available. Block, they argue, is not then in a position to provide evidence regarding conscious experience independent of access since it is access that provides such evidence. It is enough for our purposes that since introspection depends on access to the conscious state, then the absence of appropriate information links to that state renders introspective judgments about it non-evidential because they are not informationally connected to the experience. Thus, if the attentional link is not present, as in

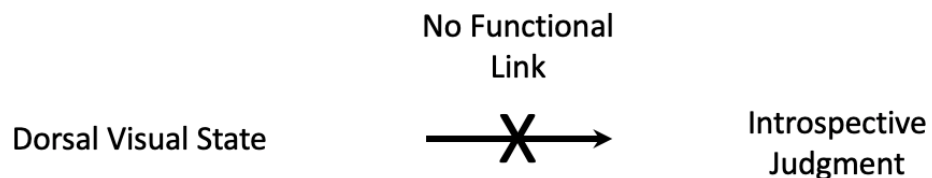
Figure 2

²⁷ Michael Cohen and Daniel Dennett, "Consciousness cannot be separated from function," *Trends in Cognitive Science*, XV, 8 (2011): 358-64, at p. 361 and Ned Block, "Consciousness, accessibility, and the mesh between psychology and neuroscience," *Behavioral and Brain Sciences*, XXX, (2001): 481-548.



this is sufficient to undercut the evidential status of introspective judgments. They are not appropriately based on experience. This means, however, that if the same holds for dorsal stream mediated visual states

Figure 3



introspective judgments regarding dorsal stream mediated vision cannot decide the issue between the thesis that the dorsal stream is unconscious versus the opposing thesis that it is conscious. I shall argue that given the two visual stream hypothesis, the link required for adequate access is not present, so the empirical argument is not sound.

4. Introspection of Dorsal Stream Vision is not Reliable

I argue that the introspective reports provided by DF and relevant blindsight subjects target visual states that are subserved by the ventral stream and not the dorsal stream. Accordingly, their reports do not provide information about the dorsal stream, so do not settle possibilities concerning it. Arguments that assume the reliability of these reports mistake the actual target of those judgments and as a result, are not sound.

Consider DF's claim that she does not see the orientation of the slot despite being able to visually guide an accurate motor movement in respect of the slot's orientation. Let us assume that her introspection is reliable in that she can recognize that her visual experience lacks a certain feature present in normal visual experience, namely the phenomenology associated with seeing the orientation of a line. Given this ability to detect an absence, via introspective attention, her introspective judgment should be correct: she does not see the orientation of the line. Yet if the judgment that her experience lacks a feature is correct, that judgment is correct about *ventral stream* mediated experience, namely regarding a defect in it. Given the assumption of functional segregation between the streams, this judgment is then not about the dorsal stream mediated visual state and should not be interpreted as such. To do so is to assume something false. Yet this is what the empirical argument for an unconscious dorsal stream assumes. Hence the argument is not sound.

Let us put the point functionally. As I argued, introspection of visual experience is a ventral stream mediated activity. DF retains preserved color and texture perception but damage to visual area LO renders her ventral stream unable to compute form and orientation. Thus, when DF judges that her visual experience is lacking a certain feature, we can understand her to be correct (how she renders that judgment will not be explained here). Her recognition of a phenomenal feature being absent from her visual experience is informed by a ventral stream mediated state that lacks that feature precisely because of damage to area LO. So, if DF's introspection is correct, it is explained by her detecting deficiencies in ventral stream mediated experience. Yet by the two visual system hypothesis, the visual state that informs her introspective judgment is not served by the dorsal stream since the dorsal stream is not for perception, namely it is not for conceptual response. Rather, it is for the guidance of motor movement. It follows that DF's reliable introspective judgment that she does not see the line does not amount to a report based on and concerned with her dorsal stream visual state. Her introspective judgment does not provide information about what is going on in the dorsal stream and cannot be used in an argument about that stream. Her introspective judgment about not seeing is a judgment about a defect in the ventral and not the dorsal stream. To treat her judgment as being informative about consciousness in the dorsal stream is to confuse the actual import of her judgment.

If Milner and Goodale are correct, there is a functional disconnection between the two streams. For the argument for unconscious vision to work, DF's claims that she does not see must give information about deficiencies or absences in the dorsal stream in respect of visual awareness. Her claims can do this only if there is an informational link between the dorsal stream and her conceptual response where the dorsal stream informs that response. Yet this is what the visual stream hypothesis denies. This means that without the necessary informational connection between dorsal stream and conceptual judgment capacities, DF's introspection cannot give evidence for the nature of dorsal stream vision, assuming she draws on no other informational sources concerning that stream.

Given the lack of an informational connection between dorsal stream visual states and introspective judgments, a theorist using DF's introspective reports to draw inferences about the

dorsal stream would be at best *guessing*. At worst, the inferences would generate false conclusions about the dorsal stream since the information provided by such reports in fact concerns the damaged ventral stream. To draw on the visual search case as an analogy, if we wished to make a judgment about whether our keys are on the dining room table, we could hardly do better than guess if we were in a different room from which the table is not visible and we did not draw on other information. Thus, for all we know from DF's introspective report, her dorsal stream might still be conscious regarding a relevant visual parameter. Critically, the argument for zombie action misinterprets DF's report, mistaking a reliable report about the ventral stream for a reliable report about the dorsal stream.

The challenge extends to blindsight subjects who are able to perform motor actions despite damage to primary visual cortex (V1). Anatomically, blindsight subjects can rely on dorsal stream processing in guiding motor behavior even though given that V1 activity is abolished, the ventral stream lacks its normal cortical visual input and will remain functionally dormant in the face of a visible stimulus. The blindsight subject seems blind to that stimulus. Objective behavior seen in blindsight such as accurate motor response to a visible stimulus in the subject's blind field is driven by dorsal stream processing drawing on visual inputs that bypass the damaged area of V1, probably through subcortical connections.

Like DF, blindsight subjects who say that they cannot see the visual features to which their motor actions can be successfully directed can be understood to correctly detect a defect in visual experience. In their case, it is the functional inactivity of the ventral stream corresponding to their blind visual field due to a lesion in V1. Yet given the two visual stream hypothesis, the blindsight subject's introspective report is based on ventral stream deficiencies and not dorsal stream processing. In the blindsight case, the defect in ventral stream processing is tied to damage in V1. Failure of V1 to respond to a stimulus leads to failure of normally correlated ventral stream activity. Since the ventral stream will not be active, the subject will report not seeing anything at all corresponding to the blind field. If the report is correct about experience, it is correct about ventral stream, not dorsal stream, deficiencies. We recapitulate in blindsight the problem with the argument for an unconscious dorsal stream appealing to DF's introspection: the subjects do not have introspective access to the dorsal stream and the visual states that it subserves. The required link on which attention would operate is not there.²⁸

The empirical argument for unconscious vision in the dorsal stream is based on the assumption that introspection is reliable in providing evidence about that stream. Yet the cited introspective reports, being based on ventral stream functioning, namely on vision for perception (conceptualization), do not provide evidence regarding the dorsal stream, namely vision for

²⁸ In Wu, "The Case for Zombie Action", op. cit., I argued from cases of neurologically intact subjects undergoing the Ebbinghaus illusion to the conclusion that their movements exemplified zombie action. Accordingly, in a common form of visually guided reach-and-grasp movement, vision is unconscious. I argued that each stream assigned a different size to the same object so that if the dorsal stream were conscious and consciousness is (plausibly) unified, the subject would visually experience a contradictory spatial content. I assumed that subjects did not since contradictory contents would be uncanny, noticeable, and introspectable. Yet subjects did not notice such contents (they did not report any such content). If my current argument is correct, my earlier assumption about introspection is incorrect. See also Christopher Mole, "Embodied Demonstratives: A Reply to Wu," *Mind*, CXXII, 485 (2013): 231–39.

action. If so, introspective reports are not reliable regarding the nature of the dorsal stream. The argument for unconscious vision, in assuming the reliability of introspective reports regarding the dorsal stream, is unsound.

5. Agency and Consciousness

I focused on empirical arguments for zombie action because philosophical discussions have drawn on the science as compelling grounds for downgrading the role of visual consciousness in agency. Those arguments make assumptions about introspection that are incorrect. Accordingly, to defend zombie action, we must fall back on nonempirical arguments for unconscious vision in the dorsal stream. For example:

1. If the dorsal stream is a phenomenally conscious stream, then it is introspectable.
2. If it is introspectable, then it would be a form of vision for perception.
3. It is not vision for perception.
4. The dorsal stream is not a conscious stream.

The underlying idea is that phenomenally conscious states must be *accessible*. One of Milner and Goodale's arguments for the dorsal stream being unconscious draws on access.²⁹ The first premise is an instance of the *access condition*: if a state is phenomenally conscious, then it is accessible, that is, it can be access conscious. Vision for perception identifies the relevant sense of access, one that fits Block's account of access:

A state is access-conscious (A-conscious) if, in virtue of one's having the state, a representation of its content is (A) inferentially promiscuous...that is, poised for use as a premise in reasoning, (B) poised for rational control of action, and (C) poised for rational control of speech.³⁰

In fact, we can discern two separable conditions, a requirement for conceptualization in (A) as needed for reasoning, hence *conceptual* access, and for the rational control of action as in (B), hence *rational* access (Block suggests (C) is not necessary).³¹ I speak of conceptual access because Block emphasizes (A) as presumably necessary. The force of (A) is that the subjects can, in principle, conceptualize and reason about what they are responding to. Given the conjunction of (A) and (B), this narrows the relevant notion of access to requiring conceptualization as well as the control of action.

²⁹ A. David Milner, "Conscious and Unconscious Visual Processing in the Human Brain," In *Frontiers of Consciousness*, Lawrence Weiskrantz and Martin Davies eds., (Oxford: Oxford University Press, 2008), pp. 169-214.

³⁰ Ned Block "On a Confusion about Consciousness," *Behavioral and Brain Sciences*, XVIII, (1995): 227-87, at p. 231. I have changed Block's numbering scheme to letters and removed a reference.

³¹ Declan Smithies, "What is the Role of Consciousness in Demonstrative Thought," *The Journal of Philosophy*, CVIII, 1 (January, 2011): 5-34. I am grateful to a referee who prompted clarifications here.

I acknowledge that (1), the access condition, is widely endorsed (recall Cohen and Dennett's challenge to Block). The argument, however, is no longer empirical in that it relies primarily on an epistemic and metaphysical assumption about consciousness. One might think that (1) is empirically supported. Experimental work is thought to support the necessity of access, as seen in the debate about phenomenal overflow, the claim that phenomenal consciousness can obtain independently of access. Given that many understand access to imply entry to the global workspace through attention as a gate,³² many opponents of overflow endorse the necessity of attention for phenomenal consciousness. Even without the global workspace account, introspection implies attention. Proponents of (1) then cite extensive work on inattentive blindness, change blindness, the inattentive blink, and hemispatial neglect as empirical confirmation that without access, there is no phenomenal awareness. These results, however, provide no empirical support for either the conceptual access condition or access tied to introspection in premise (1).

Proponents of premise (1) point out that overflow theorists have not presented a case of phenomenal consciousness outside of access. Overflow theorists are taken to face an impossible task. To provide evidence for phenomenal consciousness requires access in introspection, yet the challenge posed is to demonstrate phenomenal consciousness *without access*. This demand rules out appealing to introspection to detect overflow phenomenology since that just violates a core condition in the challenge. Hence, the overflow thesis is thought to be unverifiable.

Yet the sword cuts both ways. If access challenges overflow, it equally challenges its opponents. The access condition identifies a necessary condition: one is phenomenally conscious of X, only if one is able to access X. How does one confirm this empirically? We test necessary conditions by eliminating the condition identified in the consequent and verifying the absence of the condition expressed by the antecedent. This is standard empirical methodology. Hence, we must eliminate accessibility and demonstrate that consciousness is eliminated. Yet the problem that undercuts the empirical case for overflow also undercuts the empirical case for its denial. When one eliminates accessibility, one eliminates the access needed to detect the presence *or absence* of consciousness. If we are barred in gathering evidence for the presence of consciousness in the absence of accessibility, we are similarly barred from gathering evidence for the absence of consciousness. So if overflow is empirically unverifiable, so is the opposing position behind premise (1).

Some ridicule the overflow position as subject to the refrigerator light fallacy: one attends to the light by opening the fridge and assumes that when one is not attending to it when the door is shut, the light remains on. Yet how does one know that the light is off when the door is closed? Anti-overflow theorists must show that when the door closes, the light goes off, but how can they do so if opening the door is our only form of access? Certainly, in the fridge case, one knows how the lights work since humans build fridges. That is not in question. We do not, however, know how the brain produces consciousness and whether accessibility is a genuine necessary condition on phenomenal awareness. That *is* in question. Though, many endorse premise (1), I deny that they have empirical grounds for doing so. Rather, commitment to (1) is an epistemic and metaphysical commitment that goes beyond the empirical evidence.

³² Stanislas Dehaene and Lionel Naccache, "Towards a Cognitive Neuroscience of Consciousness: Basic Evidence and a Workspace Framework," *Cognition*, LXXIX, 1 (2001): 1–37.

Unencumbered by a misconception of the empirical evidence, we can reconsider the reasons for holding (1). The challenge is that alternative routes to supporting the access condition in (1) might beg the central question of how consciousness and *agency* are linked. The conceptual access condition that lies behind (1) invokes a specific type of action as a condition on consciousness, namely the possibility of report. This relies on a link between consciousness and conceptualization, a function of the ventral stream. To endorse (1) is to endorse a narrow access condition as necessary for phenomenal consciousness. Yet even if we agree that access consciousness is definitionally linked to behavior, why should consciousness be limited by a narrow type of behavior at the get go, namely access of the form available only to conceptual creatures?

Consider an alternative condition of access that is broader in its purview regarding agency:

A representation is access-conscious if it is poised for free use in *intentional* behavior, including reasoning and the direct “rational” control of action and speech.³³

Conceptual access, say in report or reasoning, is a type of *intentional* access but not all intentional access is conceptual access. Methodologically, in studying consciousness in humans, we prioritize conceptual access because we prioritize introspective reports and justification. As an epistemic or methodological principle, that priority is appropriate. Yet it would beg current questions to move from a methodological principle to a metaphysical requirement on consciousness. Even if access is a condition on phenomenal consciousness, perhaps it is access in the more general sense of intentional access that provides the proper constraint, something available to non-conceptual creatures as well. Methodological ease is one thing, anthropocentrism another.

Consider an alternative which contradicts the conceptual access condition as necessary for phenomenal consciousness. We might call this the *conscious intentional agency principle*, here applied to vision.

If a visual state plays a guiding role in intentional action, i.e. is intentionally accessible, then that state is conscious.³⁴

Experience Based Control affirms the role of conscious experience in motor engagement with the world and since it is (presumably) universally quantified across actions and visual states that guide action, this entails the conscious intentional agency principle: If conscious visual experience is active in control and guidance of fine-tuned motor engagement with the world,

³³ One might say that this is effectively Block’s condition (B) on access, so intentional and rational control amount to the same thing, say because the notion of an intentional action is tied to some notion of a *reason* for action. I am not sure that the ideas are equivalent. For example, one might think that there could be intentional yet substantively irrational action. To avoid hornet nests in respect of terminology, I drop the rubric *rational* access in favor of the likely broader idea.

³⁴ For an account of guidance that ties it to attention, see Wayne Wu, “Experts and Deviants: The Story of Agentive Control,” *Philosophy and Phenomenological Research*, XCIII, 1 (July, 2016): 101-26.

then conscious visual experience is active in intentional forms.³⁵ This allows us to test claims about consciousness via intentional behavior of which conceptual behavior is a proper subset.

Our discussion of the neuropsychological cases becomes relevant, for it is thought that these provide counterexamples to the intentional access condition. All neuropsychological subjects in the lab in published experiments act intentionally even if they do so with little confidence in their vision. Stoerig, Zontanou and Cowey, in adducing blindsight, noted:

In view of the striking dissociations between behavior and awareness demonstrated in man, here in particular that of blindsight, the presence of visually guided behavior is insufficient to establish whether an animal is still consciously aware of the stimulus that provokes a motor response.³⁶

DF poses a similar problem to the intentional access condition, yet if the arguments from DF and blindsight fail because of unreliable introspection, then the neuropsychological data does not pose a challenge to the intentional access condition as commonly assumed. This is just to say that there are no empirical forces pushing us in the direction of conceptual access as opposed to intentional access. These are metaphysical issues. Recognizing this puts us in a position to discuss which notion of access is required anew.

What might the correct lessons from the biology of primate vision be? Milner, Goodale, Ungerleider and Mishkin emphasize that in normal visually guided intentional behavior, both streams work seamlessly together. The additional view from Milner and Goodale is that the biological division emphasizes a subjective division between vision for action and vision for perception, the latter being conscious, the former not. I have argued against the assumptions driving that division. Consider a different view freed from unreliable introspection and the assumption of conceptual access. The biological division emphasizes that visual awareness, a subject's seeing, is divided in its neural basis with respect to output. Some aspects of visual awareness allow us to talk about it. Other aspects allow us to move accurately in light of awareness. It was a seminal discovery that visual awareness can be divided, given its neural basis, in respect of the type of actions it controls. On this view, visual states, however realized, count as phenomenally conscious, and the biology identifies different aspects of conscious guidance of primate action. I am not here arguing that both streams contribute to consciousness though differently to action, only that this position should be seriously considered.³⁷

³⁵ The position is not that intentional agency is *necessary* for consciousness, only that it is sufficient.

³⁶ Petra Stoerig, Aspasia Zontanou, Alan Cowey "Aware or unaware: assessment of cortical blindness in four men and a monkey," *Cerebral Cortex*, XII, 6 (2002): 565-74, at p. 565.

³⁷ On the current view, intentional action provides an evidential base for the presence of

consciousness. Thus, the possibility of introspective intentional action will as well. So, if we

accept the intentional agency principle, the presence of intentional agency, as in DF's motor

actions, provides evidence that DF is in a conscious visual state. An open question concerns what

If visual consciousness is necessarily unified, doesn't the intentional agency principle allow that for cases where it is not? One might think this by focusing on conceptual access which demands a narrow unity in conceptualization. On that view, if there are two states of consciousness, they must be unified in a specific type of action, conceptualization in thought or verbal report. The two states must be of the sort that can be jointly conceptualized, so that we can, in principle, report their features together. This condition figured in my argument for zombie action.³⁸

In fact, the intentional agency principle conjoined with understanding primate biology suggests an alternative. Certainly, verbal report or thought about experience is one intentional response to it, but there are other responses available. In the normal case, if there are two states of consciousness, they are unified in intentional action writ large. So, if I intend to drink from a glass, my ventral stream locates a target that fits my conception of what I have to do. Here, my seeing involves visual recognition of the target as appropriate to my intended action, and it engages my intention so I am motivated to act. Then, I intentionally reach for that target guided by my seeing it, seeing that depends on the activity of the dorsal stream as well. My seeing the object guides my intentional action in a multifaceted way that is subserved by different parts of the visual system. The different moments of awareness are unified not in the sense that I can verbally report all those contents, but more broadly because I can intentionally act on all of them. Such intentional unity would be the basis of phenomenal unity.

I do not take any of this to settle controversial issues about access and the phenomenal. The point is to emphasize that there are issues to be settled. It has been thought that the empirical data supports unconscious vision in the dorsal stream, but this data relies on unreliable introspection. Our understanding of the biology of vision itself suggests that we should not use such data. Alternative routes to zombie action depend on metaphysical assumptions about the relation between access and phenomenal consciousness but these assumptions are highly controversial.

The issue between consciousness and agency, as exemplified in access, must be reconsidered. One view is that visual consciousness became available when conceptual access

might count as empirical evidence for the *absence* of consciousness in dorsal stream vision (I am grateful for a referee's query here). One possibility is this. If we had a well-developed neuroscience of consciousness with a detailed list of neural correlates of visual states, we might find a situation where we detect a neural correlate of a visual state but find no evidence that the state can engage introspection or any other intentional action. Under those conditions, we might take the state to be unconscious. Still, given a disconnection from intentional action, one might wonder whether the state is attributable to a subject and whether it is the type of state that could be conscious. These matters warrant further discussion than I am able to give them here.

³⁸ Wu, "The Case for Zombie Action" *op. cit.* p. 224.

became available. A different view is that visual consciousness became available when intentional access became available. While visual consciousness certainly was transformed by its connection to rationality, reason and conceptualization, recognizing this change is consistent with recognizing that visual consciousness was in play in a more direct way when subjects of all sorts, human and non-human, began to act intentionally.