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ORIGINAL RESEARCH

Balint's Syndrome, Visual Motion Perception, and Awareness of Space

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Abstract Kant, Wittgenstein, and Husserl all held that visual awareness of objects requires visual awareness of the space in which the objects are located. There is a lively debate in the literature on spatial perception whether this view is undermined by the results of experiments on a Balint's syndrome patient, known as RM. I argue that neither of two recent interpretations of these results is able to explain RM's apparent ability to experience motion. I outline some ways in which each interpretation may respond to this challenge, and suggest which way of meeting the challenge is preferable. I conclude that RM retains some awareness of the larger space surrounding the objects he sees.

1 Seeing Space and Seeing Objects

It is hard to imagine (perhaps it's even unimaginable), that we could ever visually experience objects without visually experiencing the space in which they are located. The claim is not just intuitively appealing, but also philosophically significant. As Schwenkler (2012) aptly demonstrates, endorsements of the idea may also be found in the writings of, among others, Kant (1787/2007), Wittgenstein (1975), and, perhaps, Husserl—as interpreted by Edith Stein (see Husserl 1997). Schwenkler finds that all these philosophers seem to hold the view on the basis of their inability to picture to themselves what it would be like to visually experience a spatial object without visually experiencing the space in which the object is located. As he puts it, on their view, "it is because a perception of spatial objects, properties, and relations independent of the awareness of space itself is found to be unimaginable that we are entitled to regard it an experiential impossibility."

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Schwenkler is unconvinced, and offers a challenging argument against this line of thought. He enlists the results of a number of experiments carried out on a patient with Balint's syndrome,[1] known as RM (Friedman-Hill et al. 1995; Robertson et al. 1997), to show that they constitute a counterexample to the claim that visual awareness of space is necessary for visual awareness of spatial objects. On Schwenkler's interpretation, RM's deficit consists precisely in that he is visually aware of spatial objects (one object at a time, to be precise), without being visually aware of the space in which these objects are located. If Schwenkler is right, then not only is a venerable philosophical position threatened; additionally, the method used to arrive at it (i.e. careful examination of the limits of one's own experience), is undermined as a source of evidence for necessarily true claims about experience.

A rival interpretation of RM's results, one that doesn't require us to abandon the idea that in visually perceiving objects, we have to perceive the space they're in, has recently been offered by French (in preparation). French claims, roughly, that RM is visually aware of space; specifically, he's visually aware of the space that exactly coincides with the object seen.

In this paper, I argue that, as they stand, neither interpretation can explain all of RM's results,[2] and I sketch what possible changes those sympathetic to each interpretation could make to accommodate the challenge I'm raising. The viability of these alternatives will show that the Kant–Wittgenstein–Husserl orthodoxy is not under threat from RM's case, without resting the argument on introspection-based grounds that the three philosophers have been taken by Schwenkler to rely on.

2 Awareness of Space and Balint's Syndrome

Before I begin, a note on methodology. It appears that both Schwenkler and French take RM's performance in the experiments as well as his verbal reports to reflect his phenomenology. That is, they draw conclusions about the phenomenal character of RM's experience from the data concerning the things RM did in the experimental conditions (including the things he said).

French makes clear that this is the assumption guiding his own interpretation (and, I take it, Schwenkler's too). He writes: "we can make judgements about the phenomenology of RM's experience on the basis of … [RM's] incredibly poor performance … in simple spatial tasks, but also (i) … the impression that RM was

[1] Lynn Robertson characterizes Balint's syndrome as: "a neuropsychological disorder that results from damage to both parietal lobes. Clinically, it includes three main symptoms: simultanagnosia (the inability to see more than one object at a time); optic ataxia (the fixation of gaze with severe problems in voluntarily moving fixation); and optic apraxia (the inability to reach towards the correct location of perceived objects)" (2003).

[2] Schwenkler's and French's case is based on the results of experiments carried out when RM's symptoms were at their worst; primarily, those reported in Robertson et al. (1997). As the authors of that study are at pains to point out, RM went through a number of stages in which his symptoms improved and then deteriorated again. It is important in discussing his case to make sure that we're all talking about the same stage in RM's history. It could be that RM's abilities differ between tests carried out at the same time. But one would expect Robertson et al to remark on this; they don't. One can thus conclude that RM's deficits are stable over shorter time-periods.

often guessing, given that he had to be prompted or coaxed to respond, and (ii) … RM's first person reports" (in preparation). I too accept this assumption in what follows.

Schwenkler unpacks the claim that in being visually aware of spatial objects, we must be aware of space in which they're located (the Apriority Thesis, AT) thus: "At least in the domain of visual experience, it is impossible for there to be spatial perception (i.e. perception of spatial objects, properties, and relations) without the awareness of space (i.e. 'space in the strict sense', or an overarching and somehow 'absolute' space within which everything is perceived as situated)" (2012). RM's experience, on Schwenkler's interpretation, violates AT. RM isn't visually aware of "an overarching … space within which everything is perceived as situated" although he is visually aware of spatial objects.

2.1 Spatial Deficits in Balint's Syndrome

In various trials that RM undergoes, his performance strongly indicates that he fails to perceive objects' locations and orientations, but he does perceive the objects themselves. Schwenkler summarizes the findings as follows:

> RM had suffered a pair of strokes that resulted in severe damage to his posterior parietal cortex, and as a consequence was unable to localize the objects he saw. For example, when shown a display with a target at one of five locations along the vertical or horizontal meridians and told to report whether the target's position was up, down, or center (in the vertical blocks) or right, left, or center (in the horizontal ones), RM averaged only 70% correct across all conditions. Similarly, when instructed to judge the relative position – left or right in one block, up or down in the other – of an "X" with respect to that of an "O" that was also presented on the screen, RM was correct approximately 50% of the time, a performance no better than chance (Friedman-Hill et al. 1995). RM could detect the target stimuli well enough; he just couldn't tell where they were, either on the screen itself or with respect to other things (2012).

In addition to doing poorly in the tests that Schwenkler lists, RM was also at chance when asked to tell whether the word he saw was located at the top or bottom of a rectangular frame. Moreover, he explicitly denied awareness of the words' locations while affirming that he had visual experience of the words: "[t]hroughout the trials he protested that he could not locate the word even though he could see it" (Robertson et al. 1997).

Lastly, while RM was able to determine correctly the identity of the letters presented to him (either an A or a T), he was at chance when determining the letters' *orientations*.

In sum, RM exhibited the following deficits of spatial experience: RELATIVE LOCALIZATION DEFICIT (RM couldn't tell at all where one object is in relation to another), ABSOLUTE LOCALIZATION DEFICIT (RM made many errors when asked to locate an object within a larger framework), and ORIENTATION DEFICIT (RM couldn't tell what orientation the object had), all the while being able to accurately perceive the object in question. All of these results were collected while RM's symptoms were at their worst.

2.2 Interpreting the Deficits: No Space and Object Space

On the basis of these deficits, Robertson and colleagues claim that, at times, "RM had … completely lost his ability to represent space" (1997). Similarly, Schwenkler concludes that RM did not, at the time of the experiments, perceive the objects as arranged in a larger spatial framework: "his experience was of a wholly unimaginable sort: not of oriented spaces that were cut off at the boundaries of the things that occupied them, but of things without *spatial locations* or *orientations*. RM perceived shapes that did not appear to be in space at all" (2012; my emphasis). Schwenkler positions his view as a development and critique of John Campbell's (2007) take on RM's case. Campbell interests lie mainly in what RM's spatial deficits say about object perception. On the former, he merely says that RM "had no spatial awareness" while allowing that he retained some ability to represent locations unconsciously. In response, Schwenkler introduces a distinction between visual spatial awareness and visual awareness of space. The former is awareness of spatial objects, properties, and relations. Schwenkler holds that RM retains the latter ability, while lacking the former. I will focus on Schwenkler's view about RM's inabilities in what follows, as it is more developed on topics relevant to this paper. However, if my overall argument is right, then it works both against Schwenkler's and Campbell's views.

If Schwenkler is correct that RM did not experience the objects as in space at all, then RM's experience falsifies AT.

Working on the same body of data, French provides an alternative explanation of RM's results. French's interpretation is that RM does see space, but the space he sees exactly coincides with the object seen—it is what French calls "object space," and it's not experienced as a *larger* framework within which the object is located. But for all that, RM, on French's view, still has—a significantly degraded—visual awareness of space.

French explains object-space as "a region of space defined exactly in terms of the object's boundaries and other spatial features." To boost an understanding of this concept, he invites us to the following thought-experiment: Imagine you see an ordinary scene involving an apple hanging on a tree, with a shed somewhere in the background.

> Now consider what we might call there-stripping, in which this perception of the apple as there becomes gradually more limited. We can conceive of this in terms of one's visual awareness transforming from a genuine case of complex scene perception to being more like what it is in simultanagnosia where just one thing is seen. So imagine that first the ground is no longer perceived. This is one bit of there-stripping, for one no longer sees the apple as above the ground. Then the shed goes. This is another bit of there-stripping as one no longer sees the apple as to the left of the shed. Then one loses a sense of the apple in relation to oneself. This is further there-stripping as one no longer

sees the apple as in front of oneself. Then other things (apples, the sky, etc.) go missing. This is yet more there-stripping as one no longer sees the apple as at such-and-such a distance from other things. Then suppose the sense of the space around the apple goes missing in that one no longer sees the apple-space as part of a larger region of space. This is more there-stripping, as the apple is now not seen as in some specific region of space identifiable as one among others (in preparation).

At the final stage of "there-stripping … all that is left is the object." But, French urges, it is at least consistent to hold that the object is still seen as located; it's seen as located in its object-space, and the object-space itself is also seen.

Both these interpretations offer elegant explanations of RM's results. RM doesn't do well on relative localization tasks because he can only see one object, either as not located in space at all, or, at least as not located within any larger space. Same goes for his inability to locate the object in absolute space; there's no experience of a larger space that RM can rely on to make correct absolute location judgments. Since there is no larger space within which the object is seen, there is no above or below either. RM doesn't see the object as oriented with respect to anything, because he's not aware of anything with respect to which the object can be oriented. There is no up or down fixed by the top and bottom of the "absolute" space that is also seen, because no such space is, in fact, seen.

In sum, both Schwenkler's and French's interpretations handle the experimental data well. However, they will both find it difficult to account for RM's ability to experience motion. And RM, even at the time when his symptoms were the worst, seems to have been able to experience an object as moving.

3 Does RM Experience Motion?

Now, this last suggestion requires unpacking. French, relying on Robertson et al.'s (1997) comments, explicitly refers to RM's deficits in motion perception when presenting the case for his own interpretation. And Robertson and colleagues relay initial results of two tests showing that RM performs very poorly on tasks requiring him to identify and track moving objects. The results of these experiments might be seen to support French's (and Schwenkler's) interpretations.

3.1 Verbal Reports and Experimental Results

However, Robertson and colleagues also mention several curious verbal reports made by RM which suggest that he *has* the ability to experience motion. RM sometimes spontaneously complained about seeing objects moving around when performing tasks unrelated to testing his motion perception: e.g. when performing a task that required localizing the letter X, "he also often commented that the Xs seemed to be moving around," and, while being tested on shape and color perception, "he frequently reported seeing motion in displays that included no moving objects … He would complain that the stationary letter whose color or identity he was naming was drifting around on the screen." Moreover, initial clinical examination strongly suggests RM's ability to notice motion. As Robertson and colleagues report "[d]uring clinical tests, it seemed that one way to draw RM's attention was to wave a hand or object in front of him. Testing by V. S. Ramachandran in 1993 showed that he could see shape from motion." Robertson et al. further report that "evaluation of [RM's] visual function by Drs. Rafal, Keltner, and Ramachandran revealed visual acuity of 20/15, intact visual fields, preserved contrast sensitivity, and color vision. He *appeared to perceive real and apparent motion* (*although this was difficult to test conclusively*), and shape from motion" (all quotations from 1997).

So, it appears that RM was able to see objects as moving while simultaneously being unable to perform above chance in tasks that require motion perception. What should we conclude from this disparity?

I think there should be a presumption in favor of giving authoritative weight to RM's reports. If, unprompted, he says he sees objects as moving, we should assume that he sees objects as moving. Moreover, the experimental results on RM's motion perception reported by Robertson and colleagues need not be interpreted as univocally supporting the view that he's unable to experience objects as moving. On some trials, RM's poor performance can be accounted for by his simultanagnosia alone; others show, at most, that his ability to perceive motion accurately is compromised; but this is consistent with RM's ability to experience objects as moving—it's just that this experience would often be illusory.

> In the first experiment testing RM's ability to perceive motion
> [RM] was supposed to track one moving object, defined by the fact that it flashed at the beginning of the trial, and ignore another identical moving object. At the end of the trial one of the two moving objects flashed and his task was to tell us whether the object that flashed at the end of the trial was the same as the object that had flashed at the beginning. RM found this task quite impossible and almost always said 'Yes,' as if the final flash attracted his attention and was then integrated with whichever object he had previously been tracking. These results seem consistent with the idea that his subjective space has collapsed around the currently attended object. When a new object captures his attention, it is seen as a continuation of the previously attended object, despite the spatial separation between the two, and he loses awareness of the first (Robertson et al. 1997).

These results are also consistent with RM's experiencing objects as being in motion. Suppose RM is only able to see one object at a time. He sees it as moving. Then, the second (qualitatively identical) object flashes, and as RM turns his attention to it, he sees it "as a continuation of the previously attended object, … and … loses awareness of the first." But it is the simultanagnosia that interferes with RM's ability to perform the task accurately, not his inability to experience an object's motion.

Robertson et al. also report the results of another experiment testing motion perception in RM. The experiment went as follows:

> Two letters, 1° in size and separated by 2°, appeared on the screen. Either both, one, or neither moved on paths that were randomly selected (with the constraint that the two letters could not overlap and that the path of each tended to return to its starting point). RM was close to chance in judging whether both, one, or neither moved. In other sessions, one and only one of each pair moved, and RM was asked to report which letter he saw moving, if any. The letters remained visible until he responded. He was close to chance in reporting which letter moved, although in at least one session, when asked how confident he was about his responses, he said he was very sure.

Here, it is more difficult to explain RM's poor performance and maintain that he's able to experience objects as moving. But we still have some options. One way would be to say that RM's poor performance is due to his trouble with feature-binding. Say the setup involves a stationary A and a moving T. RM only sees the stationary A; however, his visual system also picks up motion information from the T. RM's conscious experience "binds" the motion to the stationary letter, resulting in the illusory experience of a moving A. Binding failures occur frequently in RM, so they might explain some of his results. And the avowal of certainty in some cases further supports the view that RM is able to experience motion, even if his experience is wildly inaccurate.

Robertson and colleagues seem not to disagree with this interpretation. They describe the test as having "confirmed that RM has severe difficulties in *perceiving motion correctly*" (1997, my emphasis). They are not saying that the tests show RM's inability to experience motion. This is to say, even on the authors' own interpretation, the results don't seem to show that RM doesn't experience motion, but merely that his motion experience is often incorrect.

To further support this claim we may note that the brain area largely responsible for motion perception, area MT, is intact in RM.

In sum, we have evidence coming from RM's unprompted verbal reports, neurological damage, and from clinical examination, strongly suggesting that RM does experience objects as moving. We also have experimental evidence that fails to rule out the possibility that RM experiences objects as moving. At most, it shows that his experience of moving objects is wildly inaccurate. I conclude, then, that even at the time when his symptoms were at their worst, RM was capable of seeing objects as moving.

4 Does Motion Perception Require AT?

The conclusion of the previous section is not easy to square with Schwenkler's or French's interpretations of the data on RM. Intuitively, it would seem as if perceiving a moving object requires perceiving it to change position; that is, to move across some sort of background (rather than, say, inferring a change of position from static cues); hence, it seems that *perceiving motion would require sorting the visual scene into some form of dynamic figure and static background.* Let's call the italicized thesis the dynamic apriority thesis, or DAT. If DAT is right, then RM's ability to perceive an object's motion would indicate that he does see the object in some larger space, against some sort of background.

On the other hand, someone like Schwenkler or French could retort that RM's case casts doubt on the necessity of DAT, in that it shows the possibility of being aware of an object in motion without being aware of it as in some larger space (just as in the original arguments, RM's case is a counterexample to the "static" version of AT). Can this instance of "one philosopher's *modus ponens* is another's *modus tollens*" be resolved? I believe it can, in favor of the view that motion perception requires some form of differentiating between different locations in the visual field.

Research on motion perception recognizes that DAT is intuitively attractive. As Oliver Braddick (1993) puts it:

> Reliable motion perception requires processes that integrate visual motion signals from neighbouring locations in the visual field, which should have the effect of smoothing out spatial variations in velocity. However, we also require motion processing to be very sensitive to local velocity differences, so that moving objects appear sharply distinct from their background.

In order to arrive at such a percept, the visual system must first combine signals from distinct locations picked up by motion detectors. As Snowden and Freeman (2004) explain:

> Current models of how to extract the early components of retinal motion owe much to the idea that movement involves something being 'here' at one point in time and 'there' sometime later. To spot this 'here-then-there' we need a detector that compares two regions of space at two slightly different times — known colloquially as a 'delay and compare' scheme.

These detectors, consisting of specialized neurons, respond to local changes in low-level properties of stimuli, such as luminance, at adjacent locations in the visual field (which already suggests a need for differentiation between different locations in motion experience). Nonetheless, these signals by themselves are ambiguous with respect to motion direction. This is because "local measurements can reveal only the component of velocity at right angles to the edge, which is compatible with a wide range of velocities that have greater or lesser components parallel to the edge" (Braddick 1993).

To resolve the ambiguity, once the local motion signals are picked up, "[g]roups of … first-stage [local detector] neurons are connected to second-stage neurons that [then] integrate information *over relatively large areas of the scene*, in order to signal movement of whole shapes and objects" (Mather 2005).

There is debate about how precisely the visual system achieves this to yield unambiguous motion perception. However, the process appears to require the visual system to differentiate between distinct locations. As Braddick explains, the visual system must engage both in motion *integration* (ensuring that small differences in motion detection within an object are smoothed over so they are processed as coherent, unambiguous motion), and motion *segmentation* (ensuring that the differences are smoothed over only where appropriate, so two distinct surfaces aren't both processed as a single object moving). Both these processes are needed to ensure adequate representation of a moving object. Braddick says:

> if a surface has uniform or near-uniform luminance, as it moves, detectable changes occur at its boundary but not in the interior. It would be inappropriate to see this region as stationary, so presumably motion signals must be propagated from the boundary into the representation of the uniform region.

Hence, the visual system must distinguish between parts of the object where luminance changes don't occur, and parts of *the background* where such changes don't occur.

Motion integration and motion segmentation are responsible for this. In the process of motion integration, "the signals from local motion detectors should interact with those from neighbours, in a way that locally averages or smooths the values of velocity that are signaled," while processes behind motion segmentation make use of the fact that

> locations where the velocity field shows abrupt changes have particular significance, and … our visual system has a high sensitivity to these locations. Such sensitivity would be provided by differential interactions, yielding the strongest signal when the local motion measurement at one point showed a sufficient difference from that in some or all of the neighbouring points.

This shows that, to process motion, the visual system must be able to differentiate between distinct locations within the visual field, namely those that contain the moving stimulus, and those that do not (in addition to being able to detect something on both sides of the stimulus boundary). Otherwise, it would be impossible to resolve ambiguities inherent in the signals picked up by local motion-detectors in a way that allows for coherent motion-perception; it would be impossible to tell which signals are to be averaged, and which aren't, and it would be impossible to tell which surfaces with no luminance contrast are to be processed as moving, and which aren't.

Moreover, as George Mather (2005) explains, picking up information from a variety of locations, including those that do not contain motion, must be done if the visual system is to be able to differentiate between changes in luminance due to motion, and changes in luminance due to illuminating the entire scene. In order to make this distinction,

> the brain must combine information from several places in the [visual] image, rather than gathering information from just one place at a time. A change in illumination causes a change in intensity *everywhere* in the image simultaneously, whereas movement causes changes in only a very small part of the image at a time.

This suggests that to perceive motion, places where the stimulus is, and places where it isn't, must both be processed by the perceptual system. This is so it can differentiate between the situations where the increase or decrease in illumination occurs everywhere in the scene, e.g. due to lighting change, and those where it is localized, and hence due to motion.

In sum, it appears that to perceive motion, even at the earliest stage of processing, information from several places in the visual field must be combined by the visual system. Secondly, these local motion signals need to be integrated and segmented to yield the perception of "shapes and objects" moving across space. Lastly, the perceptual system must make the distinction between where the stimulus is present, and where it is absent, in order to distinguish between motion signals on the one hand (that change only at select locations), and global changes in illumination of the stimulus (that change the entire scene).

As I mentioned, it's plausible, on the balance of evidence I presented, that RM is able to experience coherent objects (from letters to houses) as moving. Furthermore, it appears that our best understanding of motion perception requires that the visual system computes motion from signals arriving from a range of distinct locations, some of which contain the moving stimulus, and some of which don't. Given that the data collected by psychologists comes from experiments in which subjects had to respond on the basis of their experience, one may expect some correlation between how the visual system processes motion, and what the experience of motion is like.

Now, there is evidence that motion processing can occur in the absence of conscious awareness. The motion aftereffect (MAE, the illusory perception of a static stimulus as moving, after exposure to a moving stimulus) occurs even in cases where the moving stimulus is rendered invisible[3] to the subjects (Blake et al. 2006; Kaunitz et al. 2011). On the other hand, MAE is significantly weaker when the moving stimulus is invisible as compared to the strength of MAE when the stimulus is visible. Interestingly, rendering the moving stimulus invisible entirely eliminates the position shift illusion, in which a briefly shown stationary stimulus is perceived as having changed its position as a result of exposure to a moving stimulus (Watanabe 2005).

The cited studies show that there is a difference in the causal effects of processing motion consciously and unconsciously. I propose to take two lessons from this: first, I predict that the distinction is also likely to be manifested when it comes to spontaneous reporting: a verbal report (especially an unprompted one) is more likely to be caused by *conscious* perception of a moving stimulus. Secondly, an empirical test of this prediction appears possible, at least in principle. Perhaps it could be examined whether RM is subject to MAE, and if, so, whether an unsuppressed moving stimulus causes a significantly larger MAE than a suppressed one. If the size of effects was not significantly different, we would have reason to think that RM's motion perception is unconscious. If there were a difference, we would have reason to think it is conscious.

Moreover, as Maruya et al. (2008) show, MAE is not always produced when the stimulus is made invisible. In particular, MAE is absent when its occurrence would

[3] Of course, it is extremely difficult to ensure that subjects are not conscious of the stimuli. However, the methods that both the Blake et al. and the Kaunitz et al. studies used to suppress the stimuli (continuous flash suppression, visual crowding, and binocular rivalry) ensure, at the very least that the subjects report not being aware of the suppressed stimuli.

require a "high-level motion detector" to process the invisible moving stimulus. This suggests that a high-level motion detector doesn't process suppressed (and thus probably unconscious) information. As Nishida and Ashida (2000) explain, high-level motion detectors are those involved in motion integration. And, as I mentioned above, motion integration is responsible for yielding perceptions of coherently moving objects. RM reports seeing not only simple shapes and letters in motion (which perhaps could be explained in terms of the operation of low-level motion detectors only), but also moving houses and cars. Thus, it looks like RM has a working high-level motion detection system that, as Maruya et al.'s findings suggest, operates primarily at a conscious level. It looks likely that RM has conscious awareness motion. Does that mean that he has to experience a moving object against a background? I think so: Since both the signals from the moving object and the static background have to be processed together by the same system through the same channels to yield a representation of motion, it seems reasonable to expect that when one is conscious, so is the other.

If this is right, then we have reason to think that the need to compare distinct locations in the visual field in order to detect motion (and to distinguish places where the stimulus is, and places where it is not) is reflected in perceptual phenomenology of motion. Since Schwenkler's and French's interpretations both deny that RM experiences places other than exactly where the object is located, they fail to account for RM's motion perception. Let's call this the MOTION EXPERIENCE CHALLENGE (MEC) to these interpretations.

5 Meeting the MEC

In this section, I will outline what I think both (something like) Schwenkler's theory and (something like) French's theory could do to meet MEC. I will call someone who would want to preserve the spirit of Schwenkler's interpretation "the no-space theorist" and someone who'd want to preserve the spirit of French's interpretation "the object-space theorist," to avoid the impression that I take Schwenkler or French to endorse anything I say below. I will also explain what I mean by preserving each theory's spirit in due course.

5.1 Experience of Motion and the No-Space View

I will assume that to preserve the spirit of Schwenkler's interpretation in light of MEC, we need to retain the idea that RM is not visually aware of space. Below I outline one line of response to MEC that the no-space theorist can reasonably get behind.

In the condition known as type-2 blindsight (Weiskrantz 1998, 2002), patients frequently report that they are able to sense motion despite denying any awareness of objects. Two current competing interpretations of the phenomenon are as follows: the dominant view seems to be that the sense of motion that the patients report is non-visual [perhaps a form of a cognitive seeming, akin to a hunch: see e.g. Brogaard (2011, 2015)]; alternatively, it has also been argued that type-2 blindsight patients' sense of motion is a form of visual awareness where the patients are sensitive to changes in luminance [see in particular Foley (2015)]. In light of what I reported about the psychology of motion processing, it looks like on the latter view, a spatial expanse of some sort needs to be experienced for that experience to occur. So it is only the first option that could help the no-space theorist.

Now, the no-space theorist could offer the following interpretation of RM's ability to experience motion: RM only sees one object at a time; the object, in virtue of not being seen as in space at all, is not seen as moving; however, RM has a non-visual cognitive hunch as of something moving, and he misattributes thus experienced motion to the seen object.

There are two ways this might be further developed, only one of which allows the no-space theorist to maintain her position. It all depends on *where* in the perceptual-cognitive processing the misattribution occurs. On the one hand, if the cognitive hunch affects perceptual *experience* of the object, then the overall experience would be as of the object moving; RM would see the object as moving, due to the two experiences fusing to yield a single visual precept. But to see the object as moving, he'd need to see it as positioned against some larger space. So this can't be attractive to the no-space theorist.

Alternatively, RM's cognitive hunch might only affect his perceptual judgment ("this object is moving") without changing the character or content of his perceptual experience. It is only in this case that the no-space theorist can maintain her interpretation of RM's symptoms. The precept remains the same (just a stationary object); it's a non-visual, cognitive seeming that accounts for RM's reports. But his *visual* phenomenology doesn't change. Such an amended no-space view retains the advantages of the original no-space position, as it can still easily explain why RM's spatial experience has all the deficits identified above.

However, the second interpretation remains in tension with the methodological principle according to which the debaters ought to take RM's reports and performances as indicative of facts about his phenomenology. Driving a wedge between what RM says he sees and what he really sees undermines this presumption. And if it can be undermined here, why not at any other stage in our discussions concerning RM's experience? Why not, for example, attribute his denials of knowledge regarding the object's position or orientation to a cognitive seeming influencing perceptual judgments rather than perceptual experience?[4] It appears there is no non-arbitrary way to justify violating the methodological presumption *here*.

In sum, in order to preserve the no-space interpretation, the no-space theorist would have to arbitrarily violate the methodological presumption guiding the interpretation of the data. This is a steep price to pay.

[4] This is an extreme example. But it serves to illustrate the point that introducing cognitive seemings into play may wreak havoc—by introducing apparent arbitrariness—on our interpretations of experimental data.

5.2 Motion Experience and the Object-Space View

Let us now move on to the other interpretation. I assume that to preserve the spirit of French's interpretation, one needs to maintain that the visible space seen by RM depends on (or is determined by) the object seen by RM.

We may observe that an object-space theorist may also appeal to the 'motion hunch' to explain RM's ability to experience motion. Obviously, this faces the same worries about the methodological presumption. However, this isn't all the object-space theorist may do.

French seems committed to the view that object space coincides exactly with the object, although he never mentions it explicitly. It is suggested in passages scattered throughout his paper, however. When inviting us to imagine what it would be like to see an object merely in object space, French describes the final stage of the experiment as one when "the sense of the *space around the apple* goes missing in that one no longer sees the apple-space as part of a larger region of space"; and as one when "*all* that is left [to see] is the object." He also says that object-space can be "trace[d] … or frame[d] (guided by the [object's] boundaries)" and that "[one] can see the extent of the [object-]space by looking to the [object] and observing *its* extension. [One] can see the shape of the space by looking to the shape of the [object] which determines it." Lastly, French draws an explicit contrast between seeing a larger space and seeing the object-space, as follows: "Seeing a larger space may well facilitate a broader view of a scene in which multiple objects can be seen at the same time, but merely seeing an object in its object-space which one also sees does not." These quotations strongly suggest that French takes object-space to coincide exactly with the object's extent. Moreover, as we will see shortly, he appeals to just this idea to explain how his theory accounts for RM's orientation deficit.

The emendation that I'd propose that might be in keeping with the spirit of the object-space theory is as follows: the object-space that RM experiences is *slightly larger* than the object on which it depends. It encompasses the object and also extends a little beyond it. The object-space still depends on the object seen (it is given its shape by the object), but it is also one in which the object can pretty straightforwardly be seen as moving. To aid our intuition, we may imagine this expanded object-space as a sort of undifferentiated, uniform background, perhaps, like this (keeping in mind that the *white* background is not part of RM's experience. It's only the black object and the grey background):

As opposed to this (which is roughly what I take RM's experience to be like on French's view; again, RM doesn't experience the background here at all):

This emendation allows the object-space theorist to explain why RM seems to perceive an object's motion. The object seems to move within its object-space. Let's see how it can explain RM's other deficits.

Since this interpretation also maintains that RM sees only one object at a time, there is no problem explaining RM's deficit with relative location tasks. RM can't see the other object with respect to which the target is positioned. Hence, he cannot tell where the latter is with respect to the former.

When it comes to the absolute location task, this interpretation fares even better than Schwenkler's and French's, as it explains why there's a difference between RM's results in determining the object's relative location, as opposed to estimating its absolute location. To repeat: RM's results in the relative location task were at chance; but in the absolute location task, RM was correct 70% of the time (above chance, but still really poor for a simple task).

Neither Schwenkler's nor French's interpretations can give a principled reason for this difference. On both interpretations RM only sees a single thing *and nothing else whatsoever* (see Fig. 1). This should make judgments about relative locations to other things that RM does not see about as reliable as judgments about absolute location in some sort of larger space, *that RM also does not see*. (That's because, according both to Schwenkler and French, RM does not have any experience of that larger space.) But there is a difference in how well RM responds in the two tasks. How can this be?

The interpretation that I'm proposing here explains different rates of error in the two tasks. This is because it is easier to see where an object is, in absolute terms, when you see it against some sort of background. It will still be harder than usual when the object fills out this background almost entirely, since different absolute positions will be more difficult to discriminate in such a case, but it makes intuitive sense that the judgments will be more accurate than if the background was not seen at all. At the very least, this is because seeing the object against the background (like Fig. 2 shows) will provide at least some clue as to the object's absolute location (that is, where the object is with respect to its background).

On the other hand, since all RM is able to see at once is the single object against some uniform, undifferentiated background, his experience will provide no clue as to where that object is located with respect to other unseen objects. Hence the difference in the error rate for his two tasks.

A bigger issue may arise with respect to RM's inability to recognize the orientation of the objects whose identity he easily recognizes (RM can reliably tell if what is presented to him is the letter A or the letter T; but he can't tell whether the letters are upside down or not). Here's French's take on why his object-space interpretation can explain this deficit:

> seeing the object-space will not help RM to see objects as positioned within space, relative to a global frame of reference. Even if RM could see the object-

Fig. 1 An apple seen in apple-space that coincides exactly with the apple itself

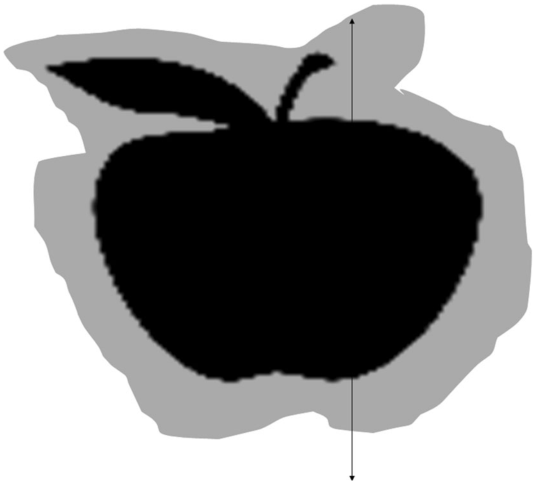

Fig. 2 An apple seen in apple-space that extends a little beyond the apple; the apple may be seen as moving

space of a letter A which he sees, that would not help him to see the A as upside down. Seeing an A in this way requires seeing the top of the A as pointing down in a region of space. But this requires the top of the A to visibly dissociate from the top of the space. Thus it requires the seen space to be perceived as having spatial structure independently of the spatial structure the object is perceived as having. But seeing the A-space doesn't give RM the independent space perception which would facilitate such awareness of the A as upside down. The spatial structure the object-space is seen as having is fixed just by the spatial structure the object is seen as having.

It doesn't look like this kind of reply is available to the expanded object-space theorist. This is because, on the expanded view, there is a possibility for the top of the object seen to "visibly disassociate from the top of the space." So, is the expanded object-space theorist required to abandon her view?

Not necessarily. She may insist, first, that failure to experience an object's orientation does not entail the failure to experience it as being in some sort of larger space. She may then explain how it is that RM can see what the object is without seeing how the object is oriented in space, all the while seeing the object as being in some sort of larger space. She can suggest, for instance, that we may compare the character of RM's experience to the character of ordinary experience of objects in peripheral vision.

Ordinary humans, as it turns out, are fairly good at categorizing pictures (telling what the picture is a picture of) even when the pictures are presented to far peripheral vision. E.g. subjects performed way above chance even for stimuli appearing at eccentricity 51.5° when the task was to categorize the target stimulus as belonging to a certain kind, e.g. animal (Thorpe et al. 2001). There is thus a good reason to believe that we're able to recognize the objects even in such unfavorable conditions.

Yet, results of a *different* experiment, ran on visually unimpaired subjects (Sally and Gurnsey 2003) provide evidence that, when an object is presented to peripheral vision, we are not very good at determining its orientation. In this experiment, the subjects' judgments of the spatial *orientation* of the stimulus were poor (at chance) when the stimulus was removed from foveal vision even by as little as 8°. This suggests that the ability to correctly categorize a complex stimulus and the ability to correctly report stimulus orientation could come apart even in ordinary (peripheral) vision. But it doesn't seem right to say that the stimuli that are correctly categorized are experienced as not in space at all (e.g. they can be seen as being to the right or to the left of the subject). Hence, RM's results in which he was able to correctly identify objects without being able to correctly determine their orientation are consistent with him seeing the objects as being in some larger space. Of course, RM is able to do more than merely categorize the letters. He can distinguish them, one from another. What the pair of experiments I cited shows, however, is that we have evidence that recognitional capacities and capacities for orientation discrimination may come apart, without entailing that the stimulus is not seen as in space at all.

This opens up a further avenue for speculation regarding the content of such experiences (both the ones like RM has, and the ones that can be had in neurotypical people). For example, it could be held that such experiences only represent spatial properties "generically" without representing any specific spatial properties. This speculation generates the right kind of predictions to explain RM's deficit. He can't tell what orientation the object has, because he only experiences it generically: his experience leaves it open exactly how the object is oriented.

There is some discussion about how best to account for generic phenomenology (see Block (2007) and commentaries therein for a range of theoretical possibilities we have), but it is a position with phenomenological plausibility in a number of situations, aside from the cases in hand.

In sum, expanded object-space view is capable of handling MEC. It doesn't require us to abandon the methodological constraint under which French and Schwenkler operate. It has an explanation available for all of RM's deficits. On the whole this amended view is preferable to the amended no-space view.

6 Alternative Model for RM's Motion Experience

Another explanation that could be offered for RM's claims is this: ever since Helmholtz, we have known that it is possible for normal observers to experience apparent displacement of their entire visual world (an intuitive demonstration can occur when you press a side of your eyeball with your finger). But such an experience is an experience of (something like) motion in the absence of anything moving against a larger background. When your entire visual field moves, there is nothing with respect to which you see it moving. It is possible that RM experiences a sensation of precisely this kind when he says that he sees things as moving. He perceives his entire visual field—that only consists of a single object—to move in just this way.

A more systematic testing of the experience of displacement of the entire visual field was carried out by Stevens et al. (1976). In the Stevens study, the participants were given either a partial or a full paralysis of eye muscles which prevented or significantly impaired eye movements, including the saccades. After being administered with either a low dose or a high dose of curare (the paralyzing substance), the participants were then asked to look at the stimulus, consisting of words and other shapes flashed on the screen. The sensations produced by the experiment were described as involving a displacement of the entire visual field:

> When an attempt was made to make a fast saccade upward for example, the visual world would disappear or "jerk" and reappear above its original spatial locus. This was described as a sensation of displacement rather than actual movement. [One participant said:] "-The world did not move… it was not as if you had taken the stimulus and moved it across the screen… when I moved my eyes up, the whole screen was displaced up… (the stimulus) disappeared and then popped up again in another place." The displacement was preceded either by a very rapid jump or a blanking out of the visual input during the saccades.

Now, RM doesn't report any jumps, so there is at least some reason to think that he doesn't experience motion in this way. However, when the Stevens et al. study participants were given a higher dose of curare, the displacement sensations felt different. As the authors explain:

> JKS [a participant, and also the principal author of the study] felt that his perceptions were much the same as seen during the low dose experiments, but *this displacement was not punctuated by jumping*. That is, no jerk, jump, or blanking out of the visual input was perceived during the attempted saccade during total paralysis. The jumping had been very striking in the low dose experiments and had made the displacement illusion quite apparent. JKS emphasized that the displacement perception was not necessarily visual in nature, and found it very difficult to describe. Later, a third total paralysis experiment was carried out, and again JKS reported the same perceptions described in the second total paralysis experiment. When he attempted to move his eyes to the right, they felt paralysed, yet the visual world was spatially relocated to the right. As before, he emphasized the perception was not visual.

In the discussion section, the authors provide some further explanation of this phenomenology:

> pure displacement is not normally experienced and thus very difficult to describe. It is *not necessarily visual in nature*, but simply the feeling that if you wanted to touch a given object you would have to reach to the right, left, up or down, etc.

On the basis of these reports, we may, it appears, conclude that it's possible to experience your entire visual field as getting displaced. RM's entire visual field (so to speak) consists of a single object. Hence, it's possible for RM to experience the object he's aware of without having to experience that object as positioned against some sort of background. Thus, RM doesn't need to see the object as against some larger background to have sensations of movement, if his sensation is like that of the whole visual-field displacement in the Stevens experiments. Perhaps a non-visual aspect of RM's phenomenology can account for his experience of motion, without that experience having to be as of an object moving against a larger background.

The situation here bears a striking similarity to the one in Christopher Peacocke's (1992) famous example: as Peacocke points out, Buckingham Palace looks different when looked at straight ahead than it does when your face is in the same position but your body is turned to one side, even though the visual image on the retina is the same in both cases. Something similar could be happening in the non-visual experience of visual field displacement; and thus, something similar could be happening in RM's experience of displacement.

However, the displacement model is not appropriate to use for RM's experience.

This is because experiencing the array in the way that Peacocke describes requires, at the very least, some awareness of how the visually perceived scene is related to one's body; the description Stevens offers also hints that that is the case. It might be that this awareness is not everything that's accounting for the phenomenal difference, but it is *a part* of it. Robert Briscoe (2014) makes this point about Peacocke's example eloquently:

> [Since t]he visual system… initially encodes an object's location relative to the eye (that is, in retinocentric coordinates) …, [r]epresenting an object's location in visual experience relative to the torso thus presupposes *prior integration of visual information about the object's eye-relative location with proprioceptive information about the spatial configuration of the body*, in particular, information about the direction of gaze and the orientation of the head.

So, the Buckingham experience appears to require integration of the visually perceived objects and properties with how the rest of the body is felt to be aligned. But RM lacks such awareness. His visually-guided action is severely compromised, and it makes sense to understand it as a result of the inability to integrate proprioceptive and visual input [e.g., he does better when it comes to reaching to targets after he closes his eyes (Baylis and Baylis 2001)]. The awareness of where his body is positioned relative to what he perceives appears to be lacking.

The phenomenology present in the displacement experiences and the Buckingham experiences, on the other hand, does require the subject to have some awareness of how the visually specified locations of objects relate to proprioceptively specified location and orientation of the body. Hence, it cannot serve as a model for what happens in RM when he says he experiences motion.

One may insist that RM's motion experience is dissimilar from the Peacocke/Stephens one in that it *is* visual. Perhaps, someone could claim, RM sees the entire visual field as having shifted, vertically or horizontally. But to attribute motion phenomenology to visual content, one would have to assume that RM can represent egocentrically specified spatial locations, such as up and down, and left and right (so that he could experience, somehow, his entire visual field visibly shifting leftward).

Now this does not appear available to Schwenkler or French, as they do not credit RM's experience with this sort of content. Schwenkler does not think that RM experiences anything at a location in a larger space, and one of the "there-stripping" stages that French discusses includes the removal of egocentric content too.

It is thus unlikely that RM can both experience the motion of an object and lack any conscious experience of a larger space in which the object he experiences is located. What this shows is that neither Schwenkler's not French's explanations of RM's predicament are mandatory. Moreover, both these interpretations struggle to explain why there's a difference between how RM does on the relative vs. absolute location tasks. The interpretation that I offer as an emendation to French's original theory, in contrast, is able to account both for RM's ability to experience motion, and for the difference in his performance in the two localization tasks.

7 Conclusion

The idea that visual spatial awareness requires visual awareness of space is, as Schwenkler demonstrates, something of a philosophical commonplace, shared by thinkers of the highest caliber, such as Kant, Wittgenstein, and Husserl. RM's case presents a problem for this idea. I have summarized two plausible interpretations of that case present in the literature, argued that they both face a challenge from RM's apparent ability to experience motion, and sketched possible ways of responding to this challenge. On the whole, it appears that the expanded object-space interpretation should be favored over the no-space interpretation.

As a result, there is no need to abandon the Kant–Wittgenstein–Husserl insights, while, simultaneously, sharing Schwenkler's reservations about the methodology they used to reach those insights. Nothing I have said here shows that the truth of AT is to be decided solely by conceptual analysis or phenomenological reflection. Schwenkler argues convincingly that philosophical theses such as AT may well be subject to empirical refutation. This paper does not challenge that.

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