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Hallucination as Mental Imagery

Abstract: *Hallucination is a big deal in contemporary philosophy of perception. The main reason for this is that the way hallucination is treated marks an important stance in one of the most hotly contested debates in this subdiscipline: the debate between ‘relationalists’ and ‘representationalists’. I argue that if we take hallucinations to be a form of mental imagery (as the literature in neuroscience and psychiatry routinely does), then we have a very straightforward way of arguing against disjunctivism: if hallucination is a form of mental imagery and if mental imagery and perception have some substantive common denominator, then a fortiori, perception and hallucination will also have a substantive common denominator.*

1. Introduction

A simple way of summarizing the debate between ‘representationalists’ and ‘relationalists’ is the following. Representationalists take perceptual states to be representations: perceptual states represent the world as being a certain way. This representation may or may not be correct. One way in which it can be incorrect is if we are hallucinating. Relationalists deny that perceptual states are representations: they argue that perceptual states are partly constituted by the perceived object. But, if this is so, then hallucinations (where there are no perceived objects) are radically different from veridical perceptual states (Brewer, 2011; Martin, 2004; Campbell, 2002).

So one way of contrasting representationalist and relationalist accounts of perception is to ask what veridical perception (the good case — when things go well) and hallucination (the bad case — when

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things go wrong) have in common. Representationalists say they have an awful lot in common: they are mental states of the same kind, it's just that one of them (veridical perception) is correct, whereas the other one (hallucination) is not. But relationalists say they do not have much in common.

In fact, one influential brand of relationalism, namely, disjunctivism, makes this attribute of some relationalist theories explicit already in its name.¹ But more care is required to be clear about what it is that disjunctivists deny: they do not deny that veridical perception and hallucination have anything in common. They clearly have a lot in common — they are both mental states, for example. And they can have very similar phenomenal character. What disjunctivism denies is that veridical perception and hallucination have anything substantial in common — whatever substantial means (see Nanay, 2015b, for an analysis of the essentialist assumptions behind this way of thinking about disjunctivism).

I will argue that if we take hallucinations to be a form of mental imagery (as the literature in neuroscience and psychiatry routinely does, see below), then we have a very straightforward way of arguing against disjunctivism: if hallucination is a form of mental imagery and if mental imagery and perception have some substantive common denominator, then *a fortiori* perception and hallucination will also have a substantive common denominator.

The structure of the paper is simple: in Section 2 and 3, I argue that hallucination is a form of mental imagery and, in Section 4, I argue that mental imagery and perception are similar in some important, substantive respects. I conclude on the basis of these two claims in Section 5 that hallucination and perception are not at all radically different (as disjunctivists argue).

2. Mental Imagery

Given that much of the argumentative structure of this paper depends on the concept of mental imagery, I need to say more about what I mean by this concept. It is important to emphasize that this paper is about mental imagery and not about imagination in general. There are many uses of the term 'imagination' and it is not easy to pin down

¹ There are some further wrinkles: one can be relationalist without being disjunctivist and one can be disjunctivist while endorsing representationalism about veridical perception (see Pautz, 2010, for analysis).

what they are and how they differ. But what I want to focus on is not any of the senses of the term ‘imagination’, but the concept of mental imagery. Having mental imagery of an apple should be differentiated from *imagining that* there is an apple in the kitchen, an imagining episode which amounts to having a propositional attitude (see, for example, Kind, 2001; Gregory, 2010; 2014; Van Leeuwen, 2011).² And having mental imagery should not be confused with what is sometimes referred to as ‘sensory imagination’ either. Sensory imagination (e.g. imagining seeing something) is one way in which we can exercise our mental imagery, but not the only one.

What is mental imagery then? A good starting point is the definition of mental imagery in Kosslyn and colleagues:

Visual mental imagery is ‘seeing’ in the absence of the appropriate immediate sensory input, auditory mental imagery is ‘hearing’ in the absence of the immediate sensory input, and so on. Imagery is distinct from perception, which is the registration of physically present stimuli. (Kosslyn, Behrmann and Jeannerod, 1995, p. 1335)

Another influential characterization of mental imagery comes from Roger Shepard:

The relation of a mental image to its corresponding object is in some ways analogous to the relation of a lock to a key... the lock can be externally operated only by its corresponding key... It may also be possible to operate the lock, at least partially, by direct manipulation of its mechanism from the inside, in the absence of its external key. (Shepard, 1978, p. 130)

These quotes are supposed to be representative of the way the concept of mental imagery is used in perceptual psychology. They are by no means cherry-picked. Here is the definition used in a very recent review article on mental imagery: ‘We use the term “mental imagery” to refer to representations... of sensory information without a direct external stimulus’ (Pearson *et al.*, 2015).

I take it that the way the concept of mental imagery is used in the empirical literature points in the direction of the following definition (which will be my definition of mental imagery in this paper): mental imagery is *perceptual processing that is not triggered by corresponding sensory stimulation in the relevant sense modality*. By perceptual processing I mean the kind of processing that also goes on in

² Propositional imagination can, of course, also involve the exercise of mental imagery, so these two categories are not meant to be exclusive.

perception. Some philosophers are very precious about the term ‘perception’: they take perception to presuppose not only the corresponding sensory stimulation, but often also the existence and presence of the perceived object. I am not so precious. But if you are, then you can read ‘quasi-perceptual processing’ in lieu of ‘perceptual processing’ in the definition of mental imagery. By sensory stimulation, I mean the activation of our sensory organs, for example, light hitting our retina in the visual sense modality. An important advantage of using this empirically inspired definition is that it allows us to be neutral with regards to some features often attributed to some standard examples of mental imagery.

Here is a standard example of mental imagery: close your eyes and visualize an apple. This (if you are successful) gives rise to the mental imagery of an apple. This is clearly one example of mental imagery, but in some ways a misleading, or at least unrepresentative, one. First, mental imagery is not necessarily visual: I use the term ‘mental imagery’ to cover visual, auditory, tactile, olfactory, etc. imagery.

Second and more importantly, the example of closing one’s eyes was an example of an active, intended, and voluntary act. But mental imagery can also be passive and neither intended nor voluntary. We can have mental imagery even if we are not trying to visualize anything — when, for example, we are having involuntary flashbacks to some scene that we have seen earlier. This is especially clear in the auditory sense modality, as demonstrated by the phenomenon of ear-worms: tunes that pop into our heads and that we keep on having auditory imagery of, even though we do not want to. Further, if mental imagery is a necessary feature of episodic memory (Byrne, Becker and Burgess, 2007; see also Berryhill *et al.*’s, 2007, overview), then it is also involuntary inasmuch as episodic memory can also be involuntary.

Third, the example of closing one’s eyes and visualizing an apple is somewhat atypical inasmuch as the apple I visualize with my eyes closed is likely to be in some abstract visualized space. But I can also visualize an apple in my egocentric space: I can visualize an apple to be right here on the keyboard of my laptop. Again, having mental imagery of something in our egocentric space is not something unusual — we use mental imagery this way very often. When you are looking at your empty living room, thinking about what kind of furniture to buy, you’re likely to try to form mental imagery of, say, a sofa not in an abstract space ‘in the mind’s eye’, but in your living room. And when you’re trying to figure out whether this sofa would

fit through the main entrance, again, you are having mental imagery of the sofa in the very concrete space of the main entrance of your house.

Finally, I will assume that mental imagery, like most mental states, can be conscious or unconscious. Closing one's eyes and visualizing an apple is clearly a conscious instance of mental imagery, but mental imagery can also be unconscious (see also Church, 2008, and Nanay, 2010b, for some philosophical arguments; and Zeman *et al.*, 2007, 2010, 2015, for empirical support). Ian Phillips, for example, has argued that the reason why there is a significant variation in people's reports on their use of imagery is not that some of them use imagery and others don't, but that the imagery of some people tends to be conscious and the imagery of some others tends to be unconscious (Phillips, 2014).

I expect some resistance at this point from those who insist that mental imagery is necessarily conscious. My response to this is that I want to follow the way vision scientists and perceptual psychologists use the term. Take the two definitions of mental imagery I quoted above: one from Kosslyn, Behrmann and Jeannerod and one from Shepard. Neither makes any reference to consciousness. And for good reasons. Take for example the famous mental rotation tasks, one of the most widely celebrated findings about mental imagery. There is linear correspondence between the time required for deciding whether two three-dimensional shapes are the same and the degree of rotation between these two shapes (Shepard and Metzler, 1971). Whatever these experiments say about mental imagery, they must say about mental imagery that it is not necessarily conscious as these experiments are behavioural experiments and the reasons for inferring the exercise of mental imagery are not introspective ones but they come from the timing of the subjects' responses.

These three distinctions (conscious vs. unconscious, voluntary vs. involuntary, egocentric vs. non-egocentric) are orthogonal to one another: we can have conscious egocentric voluntary mental imagery, unconscious egocentric voluntary mental imagery, conscious egocentric involuntary mental imagery, and so on.

I want to add a fourth distinction within the category of mental imagery. Mental imagery may or may not be accompanied by the feeling of presence. In the case of some standard examples of mental imagery, like closing one's eyes and visualizing an apple, it is not. When you visualize the apple, you don't have the feeling that it is right in front of you. But there is no reason why mental imagery couldn't be accompanied by the feeling of presence (especially if we

take the feeling of presence to be a metacognitive feeling; see Dokic, this issue). The mental imagery that is involved in lucid dreaming, for example, is accompanied by the feeling of presence. Sometimes (but not always) mental imagery is accompanied by the feeling of presence.

3. Hallucination

What can we say about hallucination in the light of the discussion of mental imagery I gave in Section 2? Hallucinations would clearly count as mental imagery according to the account of mental imagery I outlined here. And indeed it would count as mental imagery according to most psychological definitions of mental imagery: it is perceptual processing that is not triggered by corresponding sensory stimulation in the relevant sense modality.

The psychiatry literature treats hallucination as a form of mental imagery (see Allen, 2015, esp. Section III, for a summary).³ Here is the official medical definition from the *American Psychological Association's Dictionary of Psychology*: 'a false sensory perception that has the compelling sense of reality despite the absence of an external stimulus' (VandenBos, 2007, p. 427). If we think of hallucination this way, it very clearly falls under the definitions of mental imagery in psychology I considered above (Kosslyn, Behrman and Jeannerod, 1995; Shepard, 1978; Pearson *et al.*, 2015). Hallucination very much qualifies as "seeing" in the absence of the appropriate immediate sensory input' (as Kosslyn, Behrman and Jeannerod, 1995, would say). And it is also a representation 'of sensory information without a direct external stimulus' (as Pearson *et al.*, 2015, would say).⁴ And it also fits my own definition: it is perceptual processing that is not triggered by corresponding sensory stimulation in the relevant sense modality. In fact, some psychologists define hallucina-

³ Keith Allen's paper (Allen, 2015) has an interesting relation to the argument I am proposing here. He argues, in the light of the empirical literature, that hallucination is a form of imagination. I argue that hallucination is a form of mental imagery (and as we have seen, mental imagery is to be distinguished from imagination). Further, his conclusions are broadly 'relationalist', whereas mine are 'representationalist'.

⁴ The minority that consider hallucination to be different from mental imagery (see Ffytche, 2008) very clearly mean something else by mental imagery than I do (following the psychological consensus). More precisely, Ffytche (2008) takes mental imagery to be necessarily voluntary and we have seen that this is a dubious and unmotivated assumption.

tion in ways that are eerily similar to my own definition of mental imagery: ‘a sensory experience which occurs in the absence of corresponding external stimulation of the relevant sensory organ’ (David, 2004, p. 108; see also Aleman and de Haan, 1998, p. 657, for a very similar definition; see also Aleman and Larøi, 2008, chapter 1, for a good overview on defining hallucination). Crucially, while hallucinations form a very diverse set of mental phenomena, the early sensory cortices are activated in the vast majority of them (and in all sense modalities, see e.g. Henkin, Levy and Lin, 2000; see also Kompus, Westerhausen and Hugdahl, 2011, for a meta-analysis, and Allen *et al.*, 2008, for a summary).⁵

Hallucination is mental imagery that is conscious, involuntary, localizes egocentrically, and that is accompanied by the feeling of presence. While I want to allow for the fact that hallucination (like perception) can be unconscious, those cases of hallucination that are relevant for the disjunctivism debate are conscious. One way in which hallucinations seem very different from some paradigmatic cases of mental imagery is that they are involuntary, whereas visualizing an apple is a voluntary act. But as we have seen, voluntariness is an optional feature of mental imagery: mental imagery may or may not be voluntary. Hallucination (most of the time) also localizes its object in one’s egocentric space, but, again, as we have seen, so do many uses of mental imagery (as the example of imagining an apple standing on the keyboard of my laptop shows). Finally, one important hallmark of hallucinations is that they are accompanied by a very strong feeling of presence. That is the reason why it may be possible to confuse hallucination with perception — both are accompanied by a strong feeling of presence. But as I argued above, the feeling of presence is an optional add-on when it comes to mental imagery. Some uses of mental imagery, like the visualizing of the apple, are not accompanied by the feeling of presence. But some others are. Hallucinations belong to the latter group.

The conclusion is that both hallucinations and visualizing an apple with one’s eyes closed would count as *bona fide* instances of mental imagery. But they are very different kinds of mental imagery. While

⁵ What may constitute an exception is verbal hallucination in schizophrenia, which is allegedly brought about by activations of the parts of the brain that are responsible for inner speech (Frith and Done, 1988). But it is worth noting that these findings are consistent with activity in the primary auditory cortex (and there is some evidence that this is indeed so, see Jones and Fernyhough, 2007, and Kompus *et al.*, 2013).

both are normally conscious, other than that they are diametrically opposed with regards to the other three distinctions I made within the category of mental imagery. Visualizing an apple with one's eyes closed is voluntary, does not usually localize in one's egocentric space, and is not accompanied by the feeling of presence. Hallucination, in contrast, is involuntary, localizes in one's egocentric space, and is accompanied by the feeling of presence.

A better parallel of the kind of mental imagery hallucination is would be the somewhat controversial case of amodal completion — of the representation of occluded parts of perceived objects, like the unseen parts of the cat behind the picket fence (Nanay, 2010b; Briscoe, 2011). If amodal completion is a form of mental imagery (and I will not assume for the purposes of this paper that it is, I am only making a conditional claim), then it is involuntary mental imagery that localizes in one's egocentric space and that is accompanied by the feeling of presence — just like hallucination. Again, those who are not convinced that amodal completion is a form of mental imagery can just ignore the last couple of sentences. Maybe a bit less controversial is the kind of mental imagery that is involved in dreaming, which is also involuntary mental imagery that localizes in one's egocentric space and that is accompanied by the feeling of presence — just like hallucination.

It should be emphasized that the claim that hallucination is a form of mental imagery should not be particularly controversial either for the representationalist or for the relationalist. In fact, the relationalist should find this proposal a natural one (and some of them clearly do so — see Allen, 2015): according to the relationalist, one thing that hallucination and other uses of mental imagery have in common is that there is no perceived object that would partially constitute the perceptual state. So far, the relationalist (and the disjunctivist) should be happy with everything I have said.

4. Perception and Mental Imagery

If, as I argued, hallucination is a form of mental imagery, then the question about disjunctivism and the relation between perception and hallucination becomes a question about the relation between perception and mental imagery — something we know a lot about.

Again, disjunctivists deny that perception and hallucination have anything substantial in common. They point at what they see as a major dissimilarity: perception is partly constituted by the actual

perceived object, whereas hallucination clearly isn't, given that there is no perceived object involved (that's why it is an hallucination). And representationalists want to emphasize the similarities between perception and hallucination: they have the same (or similar) representational content, it's just that in the case of veridical perception this representation is correct, whereas in the case of hallucination it is incorrect.

If we now translate this disagreement to the relation between perception and mental imagery, the question becomes whether perception and mental imagery have anything substantial in common or whether they are radically different. There are some undeniable similarities. First, there is an almost complete overlap between the brain regions involved in perception and the brain regions involved in mental imagery, which suggests that the mental processes that make perception possible are the very same mental processes that make mental imagery possible (see, for example, Kosslyn, Thompson and Ganis, 2006). Further, the patterns of cortical activation are also similar in perception and mental imagery (Page, Duhamel and Crognale, 2011).⁶

Second, another important set of experimental findings in this context is about our eye movements during visual imagery and visual perception (I will focus on the visual sense modality for ease of exposition, but we have very similar phenomena in the olfactory sense modality — see Bensafi *et al.*, 2003 — and in audition — see Reisberg, 1992): our eye movements during visual imagery re-enact those of the perception of the same visual scene. When we visualize a scene, our spontaneous eye movements reflect the content of the visual scene (Brandt and Stark, 1997; Laeng and Teodorescu, 2002; Mast and Kosslyn, 2002; Spivey and Geng, 2001; Johansson, Holsanova and Holmqvist, 2006; Altmann, 2004; see also Laeng *et al.*, 2014, for a good summary). For example, when we perceive a pattern in a grid, our eye movements are isomorphic to our eye movements when we visualize the same pattern. But these findings are not limited to the similarities of eye movements when it comes to the perceived and visualized shape properties. The dilation of the pupil

⁶ It is important to keep apart the question about the similarity between mental imagery and perception from the grand 'Imagery Debate' of the 1980s (see Tye, 1991, for a summary). More specifically, admitting that there are important similarities between mental imagery and perception (in terms of physiology, of behaviour, or of phenomenology) does not commit one to deny that mental imagery is propositional (as long as one, like Pylyshyn, 2007, also holds that perception is propositional as well).

also reflects the brightness or darkness of the imagined scene (Laeng and Sulutvedt, 2014). I will come back to this set of empirical findings in the next section.

Third, there is a significant phenomenal similarity between conscious perception and conscious mental imagery — visualizing and seeing a yellow banana both have a yellow-ish phenomenal character, to put it very bluntly. Some philosophers and psychologists make more out of this phenomenal similarity with the help of the Perky experiments, where some subjects mistake their mental imagery for veridical perception (Perky, 1910; Segal, 1972; see also Hopkins, 2012; Nanay, 2012, for a recent debate about what these experiments in fact show).

But neither of these similarities between perception and mental imagery is decisive. The disjunctivist could dismiss these as superficial similarities (that is, in fact, what Martin, 2004, says about phenomenal similarities in general). The disjunctivist can maintain that the general structure of perception and mental imagery are radically different, in spite of the fact that they give rise to similar phenomenology. And this is indeed the very ingenious disjunctivist move about mental imagery: the *Dependency Thesis* (Martin, 2002; see also Noordhof, 2002; Gregory, 2010; 2014, for analysis — the proposal itself goes back to Peacocke, 1985). The Dependency Thesis is the view that visualizing *x* consists of representing the seeing of *x*. The basic idea is that it is not the similarity between the content of seeing and visualizing that explains why seeing and visualizing are phenomenally similar. Rather, by representing it, mental imagery inherits the phenomenal properties of seeing *x* (Martin, 2002, p. 406; Smith, 2006, pp. 53–4).

I will not argue against the Dependency Thesis here (but see Nanay, 2015a, and Noordhof, 2002; Currie and Ravenscroft, 2002; Gregory, 2010). The most straightforward alternative to the Dependency Thesis is to argue that the similarity between perception and mental imagery is indeed substantial inasmuch as perceptual content and the content of mental imagery are very similar (and maybe identical).

Any such ‘similar content view’ would need to specify what it means by perceptual content and by the content of mental imagery and there is no great consensus on either of these questions. My own view, which can be plugged in here nicely, is that perceptual content and the content of mental imagery are exactly the same: both involve the spatial attribution of properties to objects (the perceived object or the imagined object). And, in both cases, shifting one’s attention changes

the determinacy of these attributed properties: attending to the colour of the perceived apple and not to its size makes (or tries to make) the attributed colour property more determinate (Nanay, 2010a). And attending to the colour of the imagined apple and not to its size makes (or tries to make) the attributed colour property more determinate.

The only difference according to my account of the relation between perceptual content and the content of mental imagery is where this extra determinacy comes from. In the case of perception, it comes in a bottom-up manner: the extra determinacy is there in the sensory stimulus. In the case of mental imagery, there is no (corresponding) sensory stimulus, so it comes in a top-down manner from our background beliefs, memories, and expectations.⁷

There are many wrinkles to be ironed out — see Nanay (2015a) for a full exposition of this account of the similarity between perceptual content and the content of mental imagery. If we accept this way of thinking about perceptual content and the content of mental imagery, then we have a direct route to argue against disjunctivism: the content of mental imagery and perceptual content are very similar — this is a substantial structural similarity between these two kinds of mental states, not a mere superficial one, like the phenomenal similarity between the two. But if there is a substantial common denominator (i.e. representational content) between perception and mental imagery and if hallucination is a form of mental imagery, then there is also a substantial common denominator between perception and hallucination, namely, representational content, just as the anti-disjunctivist representationalist originally claimed.

5. Eye Movements

Of course, not everyone will accept my account of the similarity between the content of perception and mental imagery. Those who deny that perceptual states have content will, for example, obviously reject it. And they are the ones who tend to push for disjunctivism. But it is important to see how my strategy generalizes. Any version of the *similar content view* (see Noordhof, 2002) can be plugged into this argument. As long as the content of mental imagery and perceptual content are similar and hallucination is a form of mental imagery, we

⁷ There are, of course, mixed cases, where the extra determinacy comes partly in a top-down and partly in a bottom-up manner (Nanay, 2013; 2015a).

can conclude that there is a substantial common denominator between hallucination and perception — namely, that their representational content is similar. But the staunch anti-representationalist will still be unmoved, as any version of the similar content view by definition presupposes that perceptual states have content (which is similar to the content of mental imagery, thus, of hallucination). And one of the main motivations for disjunctivism was that it is consistent with the view that perceptual states have no content.

But even the Dependency Thesis needs to be able to explain the sets of empirical findings about the similarities between perception and mental imagery. The most important of these for my argument are the ones about eye movements. As we have seen, when we visualize a scene, our spontaneous eye movements reflect the content of the visual scene (Brandt and Stark, 1997; Laeng and Teodorescu, 2002; Mast and Kosslyn, 2002; Spivey and Geng, 2001; Johansson, Holsanova and Holmqvist, 2006; Altmann, 2004; see also Laeng *et al.*, 2014, for a good summary).

One may worry whether these findings are consistent with the Dependency Thesis at all (Nanay, 2015a). But even if they are, the Dependency Thesis needs to be supplemented with an account of why mental imagery leads to eye movements that are very similar to the eye movements that constitute the veridical perception of the same scene. According to the Dependency Thesis, visualizing *x* consists of imagining (that is, representing) seeing *x*. Seeing *x*, as we have seen, must involve eye movements. However, according to the Dependency Thesis, visualizing *x* consists of *imagining* (that is, *representing*) seeing *x*. But representing is not something that would involve specific eye movements. In fact, most often, it doesn't. It is the content of this representation, that is, the seeing of *x*, that involves eye movements. Why is it, then, that the vehicle of this representation requires identical eye movements to the ones the content of this representation requires?

My aim here is not to argue against the Dependency Thesis. My aim is to point out that the proponents of the Dependency Thesis need to give an explanation for why the vehicle of mental imagery requires identical eye movements to the ones the content of this mental imagery (the seeing) requires. And this explanation will need to talk about some important similarity between mental imagery (which, for the proponent of the Dependency Thesis, is the representation of seeing) and the perceptual state itself. When it comes to their guiding eye movements, they are similar.

It would still be open for the proponents of the Dependency Thesis to deploy the standard disjunctivist strategy of denying that this similarity is a substantial similarity — they could still say that it is a superficial similarity of the kind that phenomenal similarity provides. But this route doesn't seem very promising given what we know about the role of eye movements in perception and in mental imagery. Very briefly, eye movements are necessary both for visual perception and for mental imagery. This has been known about perception for a very long time. Eye movement is not an optional feature of visual perception. If the sensory stimulation on our retina does not change (if we have what is called a 'stabilized retinal image'), then we cease to see anything whatsoever (see Heckenmueller, 1965, for a classic overview). In general, it is an important feature of visual perception that if the retinal image remains the same even for a short time, we cease to have any visual experience. We can have visual experiences only if our retinal image changes continuously — normally as a result of the saccades and micro-saccades of the eye (see Findlay and Gilchrist, 2003, for an excellent summary). If this is true, however, then one cannot be in a perceptual state if one's retinal image is stabilized. Thus, eye movement is a necessary feature of experiencing anything visually. And eye movement is also a necessary feature of forming any mental imagery: if subjects are asked not to move their eyes during visualizing, they have difficulties imagining the scene, and if they can do so, they attribute only very rudimentary features to the imagined object (Laeng and Teodorescu, 2002; see also Mast and Kosslyn, 2002).

Importantly, eye movements do not merely serve as an enabling cause for perception and imagery. As the disjunctivist would be quick to point out, just because perception and imagery share a feature that is necessary for both, this does not mean that they have anything 'fundamental' in common (again, I'll bracket my own worries about how coherent one can be about what counts as 'fundamental' without endorsing unsavoury essentialist assumptions, see Nanay, 2015b). Here is another feature that perception and imagery share and that is necessary for both: a sufficiently high amount of oxygen in the subject's blood stream. This does not make the amount of oxygen in the subject's blood stream a 'fundamental' common denominator between perception and imagery that would disprove disjunctivism. The difference between eye movements and the amount of oxygen in one's blood stream is that the latter is a mere enabling cause of perception and imagery, whereas the former is constitutive of perception and

mental imagery. As the experiments I talked about in the last paragraph show, eye movements make the mental imagery of a triangle be what it is — if we change the eye movements, the mental imagery will no longer be of a triangle. So those who deny that perception has content need to acknowledge that whatever makes our eyes move in a certain way in the case of both the perception of a scene and the mental imagery of the same scene is something that perception and imagery share and that is not merely an enabling cause but rather something that makes these states be what they are. In other words, similarity of eye movement cannot be dismissed as a superficial similarity between perception and mental imagery.

6. Conclusion

We have found a substantial common denominator between perception and mental imagery, even according to the Dependency Thesis account. If it is true that hallucination is a form of mental imagery, it follows that there is a substantial common denominator between perception and hallucination as well. But this substantial common denominator between perception and hallucination is exactly what disjunctivism denies. If we consider hallucination to be a form of mental imagery, we have very strong reasons to doubt the truth of disjunctivism.

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References

- Aleman, A. & de Haan, E.H.F. (1998) On redefining hallucination, *American Journal of Orthopsychiatry*, **68**, pp. 656–658.
- Aleman, A. & Larøi, F. (2008) *Hallucinations: The Science of Idiosyncratic Perception*, Washington, DC: American Psychological Association.
- Allen, K. (2015) Hallucination and imagination, *Australasian Journal of Philosophy*, **93**, pp. 287–302.
- Allen, P., Larøi, F., McGuire, P.K. & Aleman, A. (2008) The hallucinating brain: A review of structural and functional neuroimaging studies of hallucinations, *Neuroscience and Biobehavioral Reviews*, **32** (1), pp. 175–191.
- Altmann, G.T.M. (2004) Language-mediated eye movements in the absence of a visual world: The 'blank screen paradigm', *Cognition*, **93**, pp. 79–87.

- Arditi, A.J., Holtzman, D. & Kosslyn, S.M. (1988) Mental imagery and sensory experience in congenital blindness, *Neuropsychologia*, **26**, pp. 1–12.
- Bensafi, M., *et al.* (2003) Olfactomotor activity during imagery mimics that during perception, *Nature Neuroscience*, **6**, pp. 1142–1144.
- Berryhill, M.E., Phuong, L., Picasso, L., Cabeza, R. & Olson, I.R. (2007) Parietal lobe and episodic memory: Bilateral damage causes impaired free recall of autobiographical memory, *Journal of Neuroscience*, **27**, pp. 14415–14423.
- Brandt, S.A. & Stark, L.W. (1997) Spontaneous eye movements during visual imagery reflect the content of the visual scene, *Journal of Cognitive Neuroscience*, **9**, pp. 27–38.
- Brewer, B. (2011) *Perception and Its Objects*, Oxford: Oxford University Press.
- Briscoe, R. (2011) Mental imagery and the varieties of amodal perception, *Pacific Philosophical Quarterly*, **92**, pp. 153–173.
- Byrne, P., Becker, S. & Burgess, N. (2007) Remembering the past and imagining the future: A neural model of spatial memory and imagery, *Psychological Review*, **114**, pp. 340–375.
- Campbell, J. (2002) *Reference and Consciousness*, Oxford: Oxford University Press.
- Church, J. (2008) The hidden image: A defense of unconscious imagining and its importance, *American Imago*, **65**, pp. 379–404.
- Currie G. & Ravenscroft, I. (2002) *Recreative Minds: Imagination in Philosophy and Psychology*, Oxford: Oxford University Press.
- David, A.S. (2004) The cognitive neuropsychiatry of auditory verbal hallucinations: An overview, *Cognitive Neuropsychiatry*, **9**, pp. 107–123.
- Ffytche, D. (2008) The hodology of hallucinations, *Cortex*, **44**, pp. 1067–1083.
- Findlay, J.M. & Gilchrist, I.D. (2003) *Active Vision: The Psychology of Looking and Seeing*, Oxford: Oxford University Press.
- Frith C.D. & Done, D.J. (1988) Towards a neuropsychology of schizophrenia, *British Journal of Psychiatry*, **153**, pp. 437–443.
- Gregory, D. (2010) Imagery, the imagination and experience, *Philosophical Quarterly*, **60**, pp. 735–753.
- Gregory, D. (2014) *Showing, Sensing, and Seeming: Distinctively Sensory Representations and their Contents*, Oxford: Oxford University Press.
- Heckenmueller, E.G. (1965) Stabilization of the retinal image: A review of method, effects and theory, *Psychological Bulletin*, **63**, pp. 157–169.
- Henkin, R.I., Levy, L.M. & Lin, C.S. (2000) Taste and smell phantoms revealed by brain functional MRI (fMRI), *Journal of Computer Assisted Tomography*, **24** (1), pp. 106–123.
- Hopkins, R. (2012) What Perky did not show, *Analysis*, **72**, pp. 431–439.
- Johansson, R., Holsanova, J. & Holmqvist, K. (2006) Pictures and spoken descriptions elicit similar eye movements during mental imagery, both in light and in complete darkness, *Cognitive Science*, **30**, pp. 1053–1079.
- Jones, S.R. & Fernyhough, C. (2007) Neural correlates of inner speech and auditory verbal hallucinations: A critical review of theoretical integration, *Clinical Psychology Review*, **27**, pp. 140–154.
- Kind, A. (2001) Putting the image back to imagination, *Philosophy and Phenomenological Research*, **62**, pp. 85–109.
- Kompus, K., Westerhausen, R. & Hugdahl, K. (2011) The ‘paradoxical’ engagement of the primary auditory cortex in patients with auditory verbal hallucina-

- tions: A meta-analysis of functional neuroimaging studies, *Neuropsychologia*, **49**, pp. 3361–3369.
- Kompus, K., Falkenberg, L.E., Bless, J.J., Johnsen, E., Kroken, R.A., Krakvik, B., Larøi, F., Loberg, E.-M., Vedul-Kjelsas, E., Westerhausen, R. & Hugdahl, K. (2013) The role of the primary auditory cortex in the neural mechanism of auditory verbal hallucinations, *Frontiers in Human Neuroscience*, 10.3389/fnhum.2013.00144.
- Kosslyn, S.M., Behrmann, M. & Jeannerod, M. (1995) The cognitive neuroscience of mental imagery, *Neuropsychologia*, **33**, pp. 1335–1344.
- Kosslyn, S.M., Thompson, W.L. & Ganis, G. (2006) *The Case for Mental Imagery*, Oxford: Oxford University Press.
- Laeng, B. & Teodorescu, D.-S. (2002) Eye scanpaths during visual imagery re-enact those of perception of the same visual scene, *Cognitive Science*, **26**, pp. 207–231.
- Laeng, B., Bloem, I.M., D'Ascenzo, S. & Tommasi, L. (2014) Scrutinizing visual images: The role of gaze in mental imagery and memory, *Cognition*, **131**, pp. 263–283.
- Laeng, B. & Sultutvedt, U. (2014) The eye pupil adjusts to imaginary light, *Psychological Science*, **25**, pp. 188–197.
- Martin, M.G.F. (2002) The transparency of experience, *Mind & Language*, **17**, pp. 376–425.
- Martin, M.G.F. (2004) The limits of self-awareness, *Philosophical Studies*, **120**, pp. 37–89.
- Mast, F.W. & Kosslyn, S.M. (2002) Eye movements during visual mental imagery, *Trends in Cognitive Science*, **6**, pp. 271–272.
- Nanay, B. (2010a) Attention and perceptual content, *Analysis*, **70**, pp. 263–270.
- Nanay, B. (2010b) Perception and imagination: Amodal perception as mental imagery, *Philosophical Studies*, **150**, pp. 239–254.
- Nanay, B. (2012) The philosophical implications of the Perky experiments, *Analysis*, **72**, pp. 439–443.
- Nanay, B. (2013) *Between Perception and Action*, Oxford: Oxford University Press.
- Nanay, B. (2015a) Perceptual content and the content of mental imagery, *Philosophical Studies*, **172**, pp. 1723–1736.
- Nanay, B. (2015b) The representationalism versus relationalism debate: Explanatory contextualism about perception, *European Journal of Philosophy*, **23**, pp. 321–336.
- Noordhof, P. (2002) Imagining objects and imagining experiences, *Mind & Language*, **17**, pp. 426–455.
- Page, J.W., Duhamel, P. & Crognale, M.A. (2011) ERP evidence of visualization at early stages of visual processing, *Brain and Cognition*, **75** (2), pp. 141–146.
- Pautz, A. (2010) An argument for the intentional view of visual experience, in Nanay, B. (ed.) *Perceiving the World*, pp. 254–309, Oxford: Oxford University Press.
- Peacocke, C. (1985) Imagination, experience, and possibility: A Berkeley-an view defended, in Foster, J. & Robinson, H. (eds.) *Essays on Berkeley*, pp. 19–35, Oxford: Clarendon Press.
- Pearson, J., Naselaris, T., Holmes, E.A. & Kosslyn, S.M. (2015) Mental imagery: Functional mechanisms and clinical applications, *Trends in Cognitive Sciences*, **19**, pp. 590–602.

- Perky, C.W. (1910) An experimental study of imagination, *American Journal of Psychology*, **21**, pp. 422–452.
- Phillips, I. (2014) Lack of imagination: Individual differences in mental imagery and the significance of consciousness, in Kallestrup, J. & Sprevak, M. (eds.) *New Waves in Philosophy of Mind*, Basingstoke: Palgrave Macmillan.
- Pylyshyn, Z.W. (2007) *Things and Places: How the Mind Connects with the World*, Cambridge, MA: MIT Press.
- Reisberg, D. (1992) *Auditory Imagery*, New York: Psychology Press.
- Segal S.J. (1972) Assimilation of a stimulus in the construction of an image: The Perky effect revisited, in Sheehan, P.W. (ed.) *The Function and Nature of Imagery*, pp. 203–230, New York: Academic Press.
- Shepard, R.N. (1978) Mental images, *American Psychologist*, **33**, pp. 125–137.
- Shepard, R.N. & Metzler, J. (1971) Mental rotation of three-dimensional objects, *Science*, **171**, pp. 701–703.
- Smith, J. (2006) Bodily awareness, imagination and the self, *European Journal of Philosophy*, **14**, pp. 49–68.
- Spivey, M. & Geng, J. (2001) Oculomotor mechanisms activated by imagery and memory: Eye movements to absent objects, *Psychological Research*, **65**, pp. 235–241.
- Tye, M. (1991) *The Imagery Debate*, Cambridge, MA: MIT Press.
- Van Leeuwen, C. (2011) Imagination is where the action is, *Journal of Philosophy*, **108**, pp. 55–77.
- VandenBos, G.R. (2007) *American Psychological Association: Dictionary of Psychology*, New York: Psychology Press.
- Zeman, A., McGonigle, D., Gountouna, E., Torrens, L., Della Sala, S. & Logie, R. (2007) ‘Blind imagination’: Brain activation after loss of the mind’s eye, *Journal of Neurology Neurosurgery & Psychiatry*, **78** (2), pp. 209–209.
- Zeman, A., Della Sala, S., Torrens, L.A., Gountouna, V.-E., McGonigle, D.J. & Logie, R.H. (2010) Loss of imagery phenomenology with intact visuo-spatial task performance: A case of ‘blind imagination’, *Neuropsychologia*, **48**, pp. 145–155.
- Zeman, A., Dewar, M. & Della Sala, S. (2015) Lives without imagery: Congenital aphasia, *Cortex*, **73**, pp. 378–380.