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Representationalism and Molyneux's question
An intermodal approach based on quality space theory

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Abstract
Representationalism is the view that perceptual experience essentially involves being in a representational state and that the phenomenal character of perceptual experience is exhausted in its representational content. In this paper, I argue that the representationalist's Simple Answer to Molyneux's question does not work because it has phenomenologically implausible consequences. Since intramodal representationalism has serious shortcomings, I suggest that the representationalist should opt for an intermodal approach. Moreover, I argue that intermodal representationalism is best supported by quality space theory so as to make sense of the claim that visual and tactile experiences of an object of a given shape differ in their representational content. On this view, the representationalist's response to Molyneux's question ultimately depends on whether the cross-modal calibration of quality spaces is innate or learned.

Keywords
Intermodal representationalism · Molyneux's question · Quality space theory · Representationalism about perceptual experience

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1 Introduction

One of the most popular views about the nature of perceptual experience is representationalism. This is the view that perceptual experience is essentially a matter of being in a representational state. It further holds that the phenomenal character of a perceptual experience is exhausted in its representational content. On this view, for example, to visually experience a ripe tomato is simply to represent that there is something red and round in one's visual field. Accordingly, representationalism claims that the phenomenal character of a visual perceptual experience of a

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ripe tomato is exhausted in its representing that there is something red and round in one's visual field.

In this paper, I will examine how representationalism may respond to a classic problem in the philosophy of perception known as Molyneux's question. First posed by William Molyneux in a letter to John Locke in 1688, then taken up by Locke in his *An Essay Concerning Human Understanding*, and later discussed in a correspondence between the two, this question asks whether a person who was born blind and learned to distinguish a cube from a sphere by touch would be able to visually distinguish a cube from a sphere after acquiring sight. More specifically, the question is whether this person would be able to tell which is the cube and which is the sphere solely on the basis of visual experience, i.e., without simultaneously touching the cube and sphere while looking at them (Locke, 1979a, pp. 145–146; 1979b; Molyneux, 1978, 1979).[1] What will the proponent of representationalism say when confronted with Molyneux's question? Are they committed to either a positive or a negative answer? Addressing Molyneux's question from a representationalist perspective is instructive because it sheds light on how representationalism might handle cases of cross-modal perception and whether it can ultimately provide a satisfactory account of them. The aim of this paper is not to reach a final verdict on Molyneux's question, but rather to explore the ways in which the representationalist might approach it, and to find out which strategy works best.

First, I will outline what is characteristic of representationalism, how it differs from rival theories, and how it is motivated (section 2). I will then examine what is the most straightforward answer to Molyneux's question from a representationalist perspective, which I will call the "Simple Answer" (section 3). Next, I will set out the problems with the Simple Answer and elaborate on the more general challenge that representationalism faces in addressing Molyneux's question (section 4). I will then consider two alternative approaches and argue that the representationalist should opt for an intermodal view because the intramodal view is afflicted with serious shortcomings (section 5). I will then argue that intermodal representationalism can be supported by appealing to quality space theory and point out that, on this view, the representationalist's answer to Molyneux's question is ultimately a matter of empirical investigation into matters of cross-modal calibration of quality spaces (section 6). Finally, I will give a brief summary of the main points of this paper (section 7).

2 Representationalism

Let us first take a closer look at representationalism. The basic idea is that to have a perceptual experience is to be in a representational state (Byrne, 2001; Dretske,

[1] Degenaar et al. (2024) provide a good introduction to the topic and the main debates surrounding it. For a comprehensive discussion of the more general issues underlying Molyneux's question, see Matthen & Cohen (2019) and Cohen & Matthen (2020).

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1995, 2003; Harman, 1990; Jackson, 2004; Lycan, 1996; Tye, 1995, 2000).[2] For example, to visually experience a ripe tomato is just to represent that there is a ripe tomato. It is therefore characteristic of perceptual experiences that they represent the subject's environment as being a certain way. More specifically, perceptual experiences represent experienced objects as having certain properties. A visual experience of a ripe tomato, for example, represents the experienced object as red, round, and medium-sized, or something along these lines. The representational content of a perceptual experience states its conditions of satisfaction (Chalmers, 2004, p. 155). These are the conditions that have to obtain for the representation to be veridical, and the world may or may not be such that these conditions are met. A perceptual experience is veridical if the experienced objects actually have the properties they are represented as having, and false if they do not. For instance, a visual experience of a ripe tomato is veridical just in case there is indeed a red, round, and medium-sized object in one's visual field, and false if there is not.

Importantly, representationalism is not simply the claim that perceptual experiences have representational content. For other theories of perceptual experience are in principle compatible with the claim that perceptual experiences are representational. The sense-datum theory holds that having a perceptual experience is a matter of being related to a sense-datum, construed as a non-physical, mental object (Moore, 1914; Robinson, 1994; Russell, 1912). Naïve realism holds that having a perceptual experience is a matter of being related to a mind-independent object (Brewer, 2011; Campbell, 2002; Fish, 2009). And the internal physical state view maintains that having a perceptual experience is a matter of the perceiving subject being in a certain kind of internal physical state with specific intrinsic properties (Block, 1996, 2010; Papineau, 2021; Tononi & Koch, 2015). Nothing these theories claim makes them incompatible with the claim that perceptual experience is representational.[3] What they all reject, however, is the view that perceptual experience is essentially representational. And this is precisely what is at the heart of representationalism: perceptual experiences are representational states by their very nature.

In addition to that, representationalism holds that the phenomenal character of a perceptual experience can be accounted for in terms of its representational content. At the very least, the representationalist must hold that phenomenal character supervenes on representational content (Byrne, 2001, p. 204; Tye, 2000, p. 45). So, perceptual experiences that have the same representational content necessarily have the same phenomenal character. In other words, there can be no phenomenal difference without a corresponding representational difference. However, this su-

[2] For a comprehensive overview of representationalism, see Bourget & Mendelovici (2014), Chalmers (2004), Lycan (2023) and Seager & Bourget (2017).

[3] Some proponents of naïve realism, such as Brewer (2006) and Travis (2004), hold that their view is in principle incompatible with the view that perceptual experience is representational. For an argument that even relationalist views like naïve realism must hold that perceptual experience is representational, see Schellenberg (2011) and Siegel (2010).

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pervenience claim leaves open the possibility that phenomenal character involves qualia in the sense of essentially non-representational features. To rule this out, representationalism is construed as the claim that the phenomenal character of an experience is exhausted in its representational content (Block, 1996, pp. 19–20; Seager & Bourget, 2017, p. 274). Taking up the example given above, this means that the phenomenal character of a visual experience of a ripe tomato is exhausted in its representing that there is a red, round, medium-sized object in one's visual field.

Well-known proponents of representationalism, such as Dretske (1995, 2003) and Tye (1995, 2000), even hold that phenomenal character is one and the same as representational content that satisfies further constraints.[4] Unlike a mere supervenience claim, such an identity thesis provides a neat explanation for the fact that phenomenal character is intimately tied to representationalism (Tye, 2002, p. 454). What is distinctive about the kind of representationalism advocated by Dretske and Tye is that it appeals to the tracking theory, according to which representation is a matter of tracking relations. On this view, a type of visual experience represents, say, redness just in case it tracks instances of redness in the subject's environment. While the representationalist must, of course, provide an account of representation in order to get their proposal off the ground, representationalism as such is silent on these matters and can, in principle, be equipped with any theory of representation. So as to keep my discussion of how the representationalist might address Molyneux's question as general as possible, I will not assume any particular account of representation in what follows. As will become clear later, however, the proposal that I ultimately defend is best understood as drawing on a structuralist notion of representation, according to which representation is a matter of structural correspondence relations. But more on this in due course.

What makes representationalism particularly appealing is that it can accommodate the common kind claim, which states that veridical perceptions, illusions, and hallucinations are fundamentally of the same kind because they can be subjectively indistinguishable. According to the representationalist, all of these kinds of perceptual experiences are fundamentally of the same kind because they are all representational states by their very nature (Dretske, 1995, pp. 111–112; 2003, pp. 73–74; Lycan, 1996, pp. 71–72; Tye, 2000, pp. 47–48). Naïve realism, by contrast, cannot accommodate the common kind claim because in hallucinations there is no

[4] Tye's (1995, p. 137) PANIC theory claims that phenomenal character is poised, abstract, nonconceptual intentional content. He introduces the criterion of poisedness, which states that experiences are available for processing in higher cognitive systems, to rule out the possibility that subpersonal states are phenomenally conscious. The abstractness criterion ensures that hallucinations and veridical perceptions can have the same phenomenal character and thus be subjectively indistinguishable, thus accounting for the common kind claim. According to the non-conceptuality criterion, a subject need not have specific concepts in order to have an experience with a particular phenomenal character, thereby allowing infants and non-human animals to have phenomenally conscious states. The view developed in Dretske (1995) appeals to similar criteria and considerations.

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mind-independent object to which the perceiving subject is related. Furthermore, representationalism can account for the claim that experience is transparent. The transparency observation states that when we focus on the properties presented in experience, e.g., by way of introspection, we look right through the experience itself and end up with the experienced objects and the properties they seem to have. The representationalist has a fairly simple explanation for this: The properties presented in perceptual experience are the very properties the experienced object is represented as having (Harman, 1990; Tye, 1995, pp. 135–137; 2000, pp. 45–51). In addition, the representationalist can also account for the external directedness of perceptual experience, i.e., the fact that it tells the experiencing subject about what is going on in its environment. The internal physical state view, however, is incompatible with the transparency observation and has trouble accounting for the external directedness of perceptual experience, because it claims that the properties presented in perceptual experience are actually properties of the experience itself. Finally, representationalism does not need to posit ontologically dubious entities to account for perceptual experience, unlike, for example, the sense-datum theory. Representationalism is particularly popular among those with physicalist aspirations because it promises a physicalistically respectable account of perceptual experience and its phenomenal character if representation can be explained in purely physical and functional terms (Bourget & Mendelovici, 2014, pp. 218–219; Lycan, 2023). This will suffice as a brief outline of representationalism and its main motivations, and we will now turn to the question of how to address Molyneux's question from a representationalist perspective.

3 The Simple Answer

As a way of working out the representationalist's answer to Molyneux's question, let us first consider what representationalism has to say about the situation before the person acquires the ability to see. At the outset, the blind person, let us call her Milena, is able to distinguish a cube from a sphere by touch. Moreover, she can reliably tell which is the sphere and which is the cube based on her tactile experience. For the representationalist, it is natural to suggest that the difference between the tactile experiences of a cube and a sphere is essentially a representational difference. Touching a sphere differs from touching a cube in that these two tactile experiences differ in the shape properties they represent their respective objects as having. While one represents the experienced object as spherical, the other represents the experienced object as cubical.

This representational difference can be nicely illustrated by considering what the corresponding conditions of satisfaction are, i.e., what has to be the case for each of them to be veridical. The tactile experience that represents the experienced object as spherical is veridical just in case the touched object is actually spherical. In contrast, the tactile experience that represents the experienced object as cubical is veridical just in case the touched object is actually cubical. Given that the repre-

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sentational content of a state expresses its conditions of satisfaction, it should be obvious that these two tactile experiences differ in their representational content. On the representationalist view, then, blind Milena can distinguish a cube from a sphere by touch and tell which is the cube and which is the sphere because there is a representational difference between touching a cube and touching a sphere.

Let us move on and consider the situation after Milena has acquired the ability to see, as in the scenario Molyneux envisions. According to representationalism, seeing a cube differs from seeing a sphere in that these two visual experiences represent their respective objects as having different shape properties. One represents the experienced object as cubical, while the other represents it as spherical. The representational difference between these two visual experiences can again be illustrated by appealing to their conditions of satisfaction: The visual experience that represents the experienced object as cubical is veridical just in case the seen object is indeed cubical, whereas the visual experience that represents the experienced object as spherical is veridical just in case the seen object is indeed spherical. We can note that the situation of seeing a cube and a sphere is quite similar to the situation of touching a cube and a sphere: In both cases, there is a difference in representational content, and it is precisely this difference that explains why Milena can distinguish a cube from a sphere.

The crucial question now is whether Milena can also tell which is the cube and which is the sphere on the basis of her visual experience alone. And if she can, what explains this fact? For the representationalist, answering these questions seems fairly straightforward: If we consider perceptual experiences of either of these objects across modalities, we will find that they have the same representational content. A tactile experience of a cube has the same representational content as a visual experience of a cube, as evidenced by the fact that they have the same conditions of satisfaction associated with them: Both a tactile and a visual experience of a cube are veridical just in case the object being touched or seen is actually a cube. Similarly, perceptual experiences of a sphere across modalities have the same representational content. Touching and seeing a sphere have the same representational content, since both a tactile and a visual experience of a sphere are veridical just in case the object being touched or seen is actually a sphere.

Thus, when Milena sees a cube and a sphere for the first time after acquiring the ability to see, her visual experiences have representational contents that are already familiar to her. Her visual experience of a cube has the same representational content in terms of shape properties as her previous tactile experiences of a cube. Likewise, her visual experience of a sphere has the same representational content as her previous tactile experiences of a sphere. Since the representation of shape properties remains constant across modalities, the representational difference between seeing a cube and seeing a sphere is exactly the same as that between touching a cube and touching a sphere. It is therefore natural to assume that it will be easy for Milena to tell which is the cube and which is the sphere. Accordingly, it is safe to assume that the representationalist's answer to Molyneux's

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question will be positive, because the sameness of representational content across modalities can explain why Milena will be able to tell which is the cube and which is the sphere on the basis of her visual experience alone. Since this way of answering Molyneux's question seems quite straightforward from a representationalist point of view, I propose to call it the "Simple Answer".

4 The problem with the Simple Answer

Now you might think that this is the end of the story. For it would seem that with the Simple Answer in hand, we can already draw a line under examining Molyneux's question from a representationalist perspective. But there is a serious problem with the Simple Answer. The representationalist who endorses it is committed to the claim that visually experiencing a cube has the same phenomenal character as tactilely experiencing it, because these two perceptual experiences have the same representational content. The same applies to the visual and tactile experiences of a sphere: Since both perceptual experiences are taken to have the same representational content, the representationalist must hold that they are also similar in their phenomenal character.

This view is likely to provoke some disagreement, for it seems rather ludicrous to claim that what it is like to have a visual experience of a cube is one and the same as what it is like to have a tactile experience of it. And likewise, it seems wholly inadequate to hold that having a visual experience of a sphere is phenomenally similar to having a tactile experience of it. In both cases, it seems phenomenologically manifest that touching and seeing a given object with a particular shape property do not produce perceptual experiences that are similar in their phenomenal character. So, while the Simple Answer provides a neat way to answer Molyneux's question from the perspective of representationalism, it has phenomenologically implausible consequences, suggesting that representationalism is in a delicate situation.

The general problem that the representationalist faces in dealing with Molyneux's question is best captured by a triad of inconsistent claims. The following way of stating the problem for the representationalist appeals to the case of seeing and touching a cube, but it can just as easily be stated in terms of seeing and touching a sphere. Here are the three claims at issue:

> (1) For all perceptual experiences, any two that have the same representational content are similar in their phenomenal character.
>
> (2) Visual and tactile experiences of a cube have the same representational content.
>
> (3) Visual and tactile experiences of a cube differ in their phenomenal character.

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This triad of claims is inconsistent, because if we assume that (1) and (2) are true, it follows that visual and tactile experiences of a cube have the same phenomenal character, which contradicts (3). If we assume that (1) and (3) are true, it follows that visual and tactile experiences of a cube do not have the same representational content, which contradicts (2). And if we assume that (2) and (3) are true, it follows that there can be a phenomenal difference without a corresponding difference in representational content, which contradicts (1).

Those who oppose representationalism will naturally tend to reject (1) and suggest that (2) and (3) taken together provide a counterexample to representationalism. Of course, this is not an option for the representationalist, since it would amount to giving up the idea that the phenomenal character of perceptual experiences is a matter of their representational content. Thus, the representationalist has basically two options for dealing with this trilemma: If they want to stick with the Simple Answer, they must bite the bullet and reject (3). If, instead, they want to accommodate what is phenomenally manifest, they must abandon (2) and provide an account of how seeing and touching a cube are representationally different.

However, there are several pitfalls in choosing the strategy of rejecting (3). The problem with this strategy is not only that it must deny that there is a phenomenal difference between seeing and touching a cube. It also has the troublesome consequence that it must claim that there is no phenomenal difference between Milena's perceptual experiences of a cube before and after she acquired the ability to see. In other words, if we were to ask Milena whether her visual experience of a cube is any different from the tactile experience of a cube she had before she acquired the ability to see, her answer would have to be "no". But this consequence seems utterly implausible and hard to swallow. For it seems perfectly reasonable to assume that by acquiring the ability to see, Milena has acquired not only a whole new set of discriminatory abilities, but also the capacity to have perceptual experiences of a novel kind.

Moreover, if the representationalist chooses this strategy, they must hold that any other mental state with the same representational content would necessarily have the same phenomenal character. For example, they would have to hold that representational states involving the representation of something as cubical, such as thoughts or states in early sensory information processing, would also have the same phenomenal character. This is problematic because it is highly controversial whether these states have any phenomenal character at all, let alone the same as a visual or tactile experience that represents the experienced object as being cubical. Assuming that it is possible to non-consciously represent something as being cubical, this strategy faces another difficulty, for it would have to account for the difference between phenomenally conscious and non-conscious representations that supposedly have the same representational content.

To be sure, the defender of this strategy may in principle deny that thoughts, states in early information processing, or non-conscious states can have the same representational content as visual and tactile experiences of a cube. If they adopt

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this line of reasoning, however, they must tell a plausible story that explains why visual and tactile experiences of a cube can have the same representational content, while it is not possible for other representational states, such as thoughts, states in early information processing or non-conscious states, to have this kind of representational content. But if they are liberal enough to assign the same representational content to visual and tactile experiences of a cube in order to make the Simple Answer work, then why should they shy from allowing these other kinds of states to have this kind of representational content as well? After all, nothing seems to stand in the way of these kinds of states possibly having the very same conditions of satisfaction associated with them as do the corresponding visual and tactile experiences.

Given these shortcomings of endorsing the Simple Answer and the strategy of rejecting (3), the representationalist would seem well advised to reject (2) instead. But for this latter strategy to work, they must provide an account of how visual and tactile experiences of a cube are representationally different. In the next section, we will look at different ways of doing this and their implications.

5 Intermodal and intramodal representationalism

To see more clearly the options available to the representationalist in this situation, it is useful to consider the distinction between intramodal and intermodal representationalism (Block, 1996, pp. 37–38; Bourget & Mendelovici, 2014, pp. 212–213; Byrne, 2001, p. 205; Speaks, 2015, p. 21). Recall that representationalism claims that experiences that have the same representational content are necessarily similar in their phenomenal character. Intramodal representationalism holds that this is true only for experiences that involve the same modality, e.g., all visual experiences or all tactile experiences. In other words, it claims that the representationalist thesis holds only within a particular modality. This is why it is called "intramodal". According to this view, experiences that have the same representational content can still differ in their phenomenal character if they involve different modalities and thus differ in their manner of representation (Harman, 1996; Lycan, 1996).[5] In contrast, intermodal representationalism is the view that the representationalist thesis holds for all experiences. As the label suggests, it claims that it also holds between or across modalities, i.e., even for experiences that may result from the involvement of different modalities, such as vision and touch. In this view, then, any phenomenal difference is invariably the result of a difference in representational content (Dretske, 1995, 2003; Tye, 1995, 2000).

Accordingly, there are two ways in which the representationalist can argue that visual and tactile experiences of a cube are phenomenally different because

[5] Importantly, manners of representation should not be confused with Fregean modes of presentation. While the former concern the representation relation, i.e., what relates the subject to the content, the latter concern the representational content itself, since they specify the guise under which the represented properties or objects are apprehended.

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of a representational difference: First, they can opt for intramodal representationalism and claim that visual and tactile experiences of a cube involve different manners of representation. While seeing a cube involves a particular visual way of representing that there is something cubical, touching a cube involves a particular tactile way of representing that there is something cubical. Since visual and tactile experiences of a cube differ in their manner of representation, there is a representational difference between seeing and touching a cube. Second, they can choose intermodal representationalism and hold that visual and tactile experiences of a cube involve different representational contents. While seeing a cube represents the experienced object with a particular visual shape property, cubical_V, touching a cube represents it with a particular tactile shape property, cubical_T. Since visual and tactile experiences of a cube represent the experienced object with different shape properties, namely cubical_V and cubical_T, respectively, there is a representational difference between seeing and touching a cube.

But which of these two approaches should the representationalist prefer? Let us first consider intramodal representationalism in more detail. On the face of it, the advantage of this view is that it can reconcile the claim that visual and tactile experiences of a cube have the same representational content with the fact that they are phenomenally different. This is because it holds that the representational difference underlying the phenomenal difference between seeing and touching a cube concerns their manner of representation rather than their representational content. Since intramodal representationalism claims that the representationalist thesis holds only within a given modality, it allows for experiences that have the same representational content but differ in their phenomenal character. This means, however, that intramodal representationalism does not reject (2) at all, since it holds that visual and tactile experiences of a cube have the same representational content. Instead, it seems more appropriate to construe intramodal representationalism as rejecting (1), at least in the way stated above, because it merely endorses a weakened version of that claim, which might be roughly stated as follows:

> (1*) For all perceptual experiences in a given sensory modality, any two that have the same representational content are similar in their phenomenal character.

Intramodal representationalism resolves the trilemma by replacing (1) with (1*), so that there is no inconsistency to begin with. For all that follows from (2) and (3) is that visual and tactile experiences of a cube differ in their phenomenal character while having the same representational content. But since (1*) merely asserts that there can be no phenomenal difference without a corresponding representational difference for experiences within a given modality, it is perfectly consistent with (2) and (3). It is doubtful, however, whether (1*) still captures the key idea of representationalism. In the picture provided by intramodal representationalism, it is not representational content that does the explanatory work, but manners of

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representation, which are best understood as a kind of functional property of a representational state that specifies the relation between the subject and the relevant content. From this perspective, then, intramodal representationalism is a watered-down version of representationalism rather than a full-fledged defense of the core representationalist commitment captured by (1).

Moreover, the maneuver of intramodal representationalism comes at the cost of positing manners of representation that cry out for further elucidation. For it is not enough simply to assert that there is a difference in manner of representation and that this results in a phenomenal difference. An adequate intramodal approach must tell us what exactly the difference is between visually and tactilely representing something as cubical, and why this results in a phenomenal difference between seeing and touching a cube. Without a principled account of what manners of representation are, how they can be individuated, and what role they play in determining phenomenal character, intramodal representationalism remains a vague and unsatisfactory approach that might even be seen as simply shifting the explanatory burden from the level of representational content to the level of manners of representation – whatever the latter may ultimately turn out to be.

Let us now turn to intermodal representationalism. According to this view, it is a mistake to think that visual and tactile experiences of a cube have the same representational content simply because we use the same linguistic expressions to describe or attribute such representational states. Instead, it claims that the representational difference between seeing and touching a cube concerns their representational content: A visual experience of a cube represents the experienced object as cubical_V, whereas a tactile experience of a cube represents it as cubical_T. The intermodal approach actually rejects (2) because it attempts to account for the phenomenal difference between visual and tactile experiences of a cube in terms of their representational content. Thus, unlike intramodal representationalism, it does not dismiss (1) in favor of something like (1*), but remains firmly committed to the key idea of representationalism.

Given that the representationalist should seek explanations that appeal to representational content whenever possible, it seems natural that they should opt for intermodal representationalism. The main merit of this approach is that it can account for the phenomenal difference between seeing and touching a cube without having to posit manners of representation. It is not clear whether intermodal representationalism is ontologically more parsimonious than intramodal representationalism because it has to posit many representational contents, whereas intramodal representationalism requires more manners of representation but fewer representational contents. Still, intermodal representationalism is simpler than its rival because it invokes only representational content, which is a kind of ontological inventory to which the representationalist is committed anyway.

The preceding discussion suggests that an intermodal approach is the representationalist's best choice for addressing the trilemma without abandoning the core idea of their position. However, the proponent of this strategy must make a case

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https://doi.org/10.33735/phimisci.2024.11601

for the claim that visual experience represents experienced objects with properties that are different from those that tactile experience represents them as having. It is not enough to simply assert that there is a difference in representational content between seeing and touching a cube. The crucial challenge for intermodal representationalism, then, is to provide support for the idea that there is indeed a difference in representational content between seeing and touching a cube. In the next section, we will consider what is probably the best way to address this issue.

6 Quality space theory to the rescue

To substantiate the claim that seeing and touching a cube differ in representational content, it is natural for the proponent of intermodal representationalism to claim that the properties represented in visual experience are different in kind from those represented in tactile experience. In what follows, I will argue that intermodal representationalism can appeal to quality space theory to support its approach and make it work. The overall line of reasoning is fairly simple: Perceptual experiences in different sensory modalities are associated with different quality spaces. Assuming that these quality spaces are the sources of representational content, perceptual experiences in different sensory modalities differ in representational content. Since visual and tactile experiences involve different sensory modalities, we can accommodate the claim that they differ in representational content by appealing to quality spaces.

But before delving into the details of this proposal, it is worth noting that quality space theory *per se* is independent of representationalism. In principle, quality space theory is compatible with qualities being properties of experienced objects, of experiences themselves, or of sense-data. Thus, it is compatible with the various theories of perceptual experience mentioned earlier, such as naïve realism, the internal physical state view, or the sense-datum theory. This means that quality space theory as such does not presuppose a representationalist view of perceptual experience. My point here is to use it as a tool to make a compelling case for intermodal representationalism and the claim that perceptual experiences in different sensory modalities differ with respect to the qualities they represent the experienced objects as having. Thus, while I do not claim that quality space theory is representational by nature, I do provide a representationalist reading of it that can be adopted by the proponent of intermodal representationalism. Moreover, quality space theory is perhaps not the only way to get intermodal representationalism off the ground. But as far as I can see, it provides the best framework for supporting the claim that visual and tactile experiences have different representational contents, not least because it is well founded in empirical insights about perceptual experience. Let us now take a closer look at quality space theory and see how intermodal representationalism can benefit from it.

Quality space theory holds that the qualities presented by experiences in a given modality can be sorted in terms of their relative similarity (Clark, 1993, 2000;

Weger, D. M. (2024). Representationalism and Molyneux's question: An intermodal approach based on quality space theory. *Philosophy and the Mind Sciences*, *5*.
https://doi.org/10.33735/phimisci.2024.11601

Rosenthal, 2010, 2015). For example, we can order the qualities presented by visual experiences, that is, color qualities, in terms of their relative similarity. Such an ordering will yield that red is closer to orange than to green because red is more similar to orange than to green. The closer two qualities are in quality space, the more similar they are, so the relative distance between qualities in quality space is a measure of their relative similarity. The number of dimensions of a given quality space depends on the number of ways in which the qualities inhabiting that quality space can differ. Since color qualities, for instance, can differ in hue, saturation, and brightness, the color quality space has three dimensions. In general, then, a quality space is a multidimensional ordering of the qualities presented by experiences within a given modality in terms of their relative similarity.

But how to determine the exact geometry of a given quality space or how to construct a model of it? According to Rosenthal (2010, pp. 373–374; 2015, p. 34), we have access to qualities not only through experience and introspection, but also through the role they play in perception. However, perception is about discriminating stimuli, but we are interested in ordering qualities, not stimuli. Nevertheless, we can use perceptual discrimination of stimuli to construct an ordering of qualities, because there is an intimate relationship between qualities and stimuli: Any given pair of stimuli that is discriminable for an individual must elicit states that present different qualities, because it would not be possible for the individual to discriminate the stimuli if they elicited states that present the same quality (Rosenthal, 2010, p. 377; 2015, p. 38). This means that a quality space captures the totality of discriminations that an individual can make with a given modality. It follows that each quality space is ultimately determined by an individual's ability to discern stimuli with the corresponding modality. These discriminatory abilities, in turn, depend on the makeup, organization, and state of the corresponding sensory system. For example, an individual's visual perceptual discriminatory abilities are a matter of the makeup, organization, and state of their visual system.

Consequently, we need to examine an individual's discriminatory behavior with respect to a class of stimuli with a given modality in order to determine a quality space for that modality. For this purpose, we can appeal to matching relations and just noticeable differences (JNDs) between stimuli (Rosenthal, 2010, pp. 377–378; 2015, pp. 38–39). Two stimuli are just noticeably different if the individual can just barely tell them apart. In other words, a just noticeable difference is the smallest possible difference between stimuli that an individual can perceive with a given modality, such that a match is only one step away. The key idea is that we can use matching relations and JNDs to construct an ordering of stimuli such that matching stimuli are grouped together and the number of JNDs between any pair of stimuli provides a measure of how easily the individual can discern them. This ordering of stimuli then provides the basis for deriving a corresponding ordering of the qualities presented by the states elicited by those stimuli. This method of constructing a quality space is indirect, in that it relies on matching relations and

Weger, D. M. (2024). Representationalism and Molyneux's question: An intermodal approach based on quality space theory. *Philosophy and the Mind Sciences*, *5*.
https://doi.org/10.33735/phimisci.2024.11601

just noticeable differences that hold between stimuli to sort the qualities presented by the states elicited by those stimuli.

It is important to note that we cannot characterize qualities in terms of the stimuli that elicit the states that present them, since this connection is only contingent and can vary from individual to individual and from environment to environment. For example, the monochromatic light required to present unique green to a healthy human with a well-functioning visual system is in the wavelength range of 480 nm to 520 nm (Hurvich, 1981, p. 223). Monochromatic light at a wavelength of, say, 505 nm may present unique green to one individual and yellowish green to another. Thus, qualities are characterized in terms of their relative location within a quality space and their relations to all other qualities in that quality space. For example, redness is the quality it is in virtue of its relations to all other color qualities, and it can therefore be individuated in terms of the location it occupies in color quality space.

Now it is time to set out how quality space theory can support the intermodal representationalist's claim that visual and tactile experiences of a cube differ in their representational content. The key idea is that visual and tactile experiences are associated with different quality spaces because distinguishing visual stimuli is different from distinguishing tactile stimuli and thus involves different modalities. This can be illustrated as follows: A given pair of stimuli belongs to the same sensory modality if they can be made to match by adjusting one of them. According to Rosenthal (2015, pp. 50–51), this requires that there be a series of just noticeable differences that connect them. Conversely, if there is no series of just noticeable differences connecting them, they do not belong to the same sensory modality. Given that there is no series of just noticeable differences from visual stimuli to tactile stimuli, visual and tactile experiences involve different modalities and are thus associated with different quality spaces. Accordingly, the qualities presented in vision are different from those presented in touch. This is also true of the qualities related to the perception of spatial properties, as Rosenthal points out:

> The spatial properties perceptible by different sensory modalities are of course the same; the physical shapes, sizes, and locations we perceive by sight are the same as those we perceive by touch. But the corresponding mental qualities are not. Vision determines spatial perceptible properties as boundaries of color, whereas tactition determines them as boundaries pertaining to perceptible pressure and texture. The mental qualities that pertain to spatial properties are special to each of the sense modalities. (Rosenthal, 2010, p. 378; see also Rosenthal, 2015, p. 59)

So, even though we perceive the same physical shape when seeing and touching a cube, the stimuli produced by the shape of the cube to which vision responds are different from those produced by the shape of the cube to which touch responds. While visual shape perception involves registering differences in color,

Weger, D. M. (2024). Representationalism and Molyneux's question: An intermodal approach based on quality space theory. *Philosophy and the Mind Sciences*, *5*.
https://doi.org/10.33735/phimisci.2024.11601

tactile shape perception involves registering differences in pressure or texture.[6] Thus, the qualities involved in seeing a cube are different from the qualities involved in touching a cube because these perceptual states are elicited by stimuli that are discerned by different modalities and are thus associated with different quality spaces.

On a representationalist reading of this story, quality spaces provide the source of the representational content of perceptual experience. This is not to say that quality spaces, or the qualities that constitute them, are the targets of representations. Rather, it means that the properties that figure in the representational content of a given perceptual experience, and that experienced objects are thus represented as having, are qualities that belong to the quality space associated with that kind of perceptual experience. Adding this extra piece to the story from the last few paragraphs, we arrive at the view that visual and tactile experiences of a cube differ in their representational content because the qualities that visual experiences represent experienced objects as having are different in kind from the qualities that tactile experiences represent them as having: Seeing a cube represents the experienced object as cubical_V, whereas touching a cube represents it as cubical_T.

To see that visual and tactile experiences of a cube have different representational contents, consider their different conditions of satisfaction: While the visual experience is veridical just in case the experienced object actually has the shape property it is represented as having in vision, the tactile experience is veridical just in case the experienced object actually has the shape property it is represented as having in touch. And it seems possible, at least in principle, for an experienced object to be perceived veridically as having one of these properties, while lacking the other. For example, a perfectly transparent cube is arguably veridically perceived as cubical_T without being cubical_V, and a hologram of a cube is arguably veridically perceived as cubical_V without being cubical_T. This corroborates the claim of intermodal representationalism that seeing and touching a cube differ in their representational content.

It is worth noting that this way of spelling out representationalism is best combined with a structuralist account of representation. According to this view, representation is a matter of an exploitable structural correspondence between what represents and what is represented (Bartels, 2006; Gładziejewski & Miłkowski, 2017; O'Brien & Opie, 2004; Shea, 2018).[7] The intermodal representationalist may argue that perceptual experiences in a given modality represent in virtue of an ex-

[6] If this sounds too much like a commitment to color realism or even color primitivism, then take "color" to refer to whatever property of the perceived object is involved in producing the stimuli to which the visual system responds. The same may be applied to pressure and texture if one is skeptical about their metaphysical status.

[7] Simply put, for a structural correspondence to be exploitable, the relation defined on the represented structure must be significant for the representing system, and the relation defined on the representing structure must be such that the representing system's processing is systematically sensitive to it (Shea, 2018, p. 120).

Weger, D. M. (2024). Representationalism and Molyneux's question: An intermodal approach based on quality space theory. *Philosophy and the Mind Sciences*, *5*.
https://doi.org/10.33735/phimisci.2024.11601

ploitable structural correspondence between the set of possible experiences in that modality and the associated quality space. For example, a given visual experience represents the experienced object as red in virtue of a structural correspondence between the set of possible visual experiences and the color quality space that maps that experience onto the location in color quality space occupied by redness.

Let us now consider what this means for the representationalist's answer to Molyneux's question. If they adopt the intermodal approach appealing to quality space theory just outlined, their answer to the question of whether Milena will be able to tell which is the cube and which is the sphere from visual experience alone depends crucially on how they conceive of the relationship between the different quality spaces. According to nativism, quality spaces are cross-calibrated from birth. Thus, although visual and tactile experiences present different qualities, there is an innate correspondence between the qualities presented in vision and in touch. If this is true, then Milena will immediately be able to tell which is the cube and which is the sphere based on visual experience alone, and the intermodal representationalist's answer will be positive. In contrast, non-nativism holds that the "[c]ross-modal calibration of the spatial properties discerned by each modality must be learned" (Rosenthal, 2010, p. 378). This means that Milena would have to learn which visual qualities correspond to which tactile qualities when she perceives a given shape. If this is true, then intermodal representationalism will give a negative answer, because Milena will only be able to tell which is the cube and which is the sphere after she has learned that things experienced as cubical_T are usually also cubical_V, and that things experienced as spherical_T are usually also spherical_V.

What can empirical studies tell us about the nativism/non-nativism debate? On the one hand, Meltzoff (1993) conducted experiments with newborn infants and found that they were able to match seen with felt when presented visually with pacifiers that they had previously experienced only by touch. Assuming that these infants, like adults whose vision has been restored, have not yet associated visual and tactile experiences of objects, the results suggest that these infants have some degree of cross-modal calibration from birth, thus supporting nativism. However, Rosenthal (2005, pp. 221–222; 2010, pp. 390–339 fn. 29) argues that these results are inconclusive because it cannot be ruled out that the one-month-old infants had already learned to match seen and felt before being exposed to the experiments.[8] On the other hand, Held et al. (2011) tested three people who were born blind but could be treated to eventually gain sight. They found that while the test subjects did not take long to identify objects that they had already touched before they gained the ability to see, they were not immediately able to do so. At first glance, these results suggest that cross-modal calibration must be learned and thus support non-

[8] Acknowledging this point, Meltzoff (1993, p. 223) nonetheless contends that it is unlikely that the children had learned to associate visual and tactile experiences of objects prior to the experiments because they did not have simultaneous visual and tactile experiences of these objects, which is usually considered to be the basis for forming associative links.

Weger, D. M. (2024). Representationalism and Molyneux's question: An intermodal approach based on quality space theory. *Philosophy and the Mind Sciences*, *5*.
https://doi.org/10.33735/phimisci.2024.11601

nativism. Yet, it is possible, as Schwenkler (2012, 2013) argues, that the subjects could not match seen with felt due to a purely visual deficit, because the tests performed to measure the subjects' visual abilities did not indicate that they were sufficiently able to visually discriminate and recognize three-dimensional shapes, which is required for intermodal matching.

This dispute between nativism and non-nativism about cross-modal calibration suggests that the intermodal representationalist's answer to Molyneux's question ultimately depends on the answer to the following question: Is cross-modal calibration of visual and tactile qualities innate or must it be learned? Given that there is no good evidence for nativism, the proponent of intermodal representationalism may be rather inclined to answer "no" to Molyneux's question. But as long as it is still an open empirical question whether cross-modal calibration is innate or learned, the proponent of intermodal representationalism, at least in the way defended here, is not committed to either a positive or a negative answer to Molyneux's question.[9] They can therefore happily await the results of further empirical investigation into these matters, and then side with the answer that is best supported by empirical evidence.[10]

7 Conclusion

In this paper, I have examined how the proponent of representationalism about perceptual experience may address Molyneux's question. According to the Simple Answer, the representationalist will answer "yes", because visual and tactile experiences of a cube have the same representational content, and the same goes for seeing and touching a sphere. But this way of answering Molyneux's question has phenomenologically implausible consequences, for it implies that seeing a cube is phenomenally similar to touching it, and that seeing a sphere is phenomenally similar to touching it. I pointed out that the representationalist thus faces the problem that the following claims form an inconsistent triad: (1) For all perceptual experiences, any two that have the same representational content are similar in their phenomenal character. (2) Visual and tactile experiences of a cube have the same representational content. (3) Visual and tactile experiences of a cube differ in their phenomenal character.

[9] There is controversy about whether Molyneux's question can be resolved once and for all by empirical research: On the one hand, Jacomuzzi et al. (2003) claim that it is impossible because vision cannot be restored at once, and thus improvements in visual abilities as a result of the restoration process cannot be distinguished from effects of perceptual learning, which would be necessary to conduct experiments that provide a conclusive answer to Molyneux's question. On the other hand, Schwenkler (2012, 2013) argues that it is simply a matter of enforcing the correct experimental conditions, which he believes is possible.

[10] This assessment is shared by Lyre (2022, p. 14, fn. 26), whose neurophenomenal structuralism is representationalist in spirit and also appeals to quality space theory.

Weger, D. M. (2024). Representationalism and Molyneux's question: An intermodal approach based on quality space theory. *Philosophy and the Mind Sciences*, *5*.
https://doi.org/10.33735/phimisci.2024.11601

I argued that the representationalist cannot reject (1) because it captures the core representationalist claim. Since rejecting (3) would commit them to phenomenologically implausible consequences, they must therefore reject (2) and abandon the Simple Answer. In the next step, I examined the options for the representationalist: While the intramodal approach claims that visual and tactile experiences of a cube differ in their manner of representation, the intermodal approach claims that they differ in their representational content. However, intramodal representationalism is not a good answer: For one thing, it remains vague without a detailed account of what manners of representation are and how they can account for phenomenal differences. For another, it solves the trilemma by dismissing (1) in favor of (1*), which turns out to be a weakened version of the key idea of representationalism.

Thus, the intermodal approach emerged as the representationalist's best choice. To make the case that visual and tactile experiences do indeed differ in representational content, the intermodal representationalist can appeal to quality space theory, as I argued. Since seeing and touching a cube involve different sensory modalities, they are also associated with different quality spaces. Assuming that quality spaces provide the representational content for perceptual experiences, visual and tactile experiences differ in their representational content. If the representationalist adopts this intermodal approach that appeals to quality space theory, then their answer to Molyneux's question depends on how they conceive of the relationship between quality spaces. This ultimately hinges on whether cross-modal calibration is innate or learned. Since there is no good evidence in favor of a nativist position, the intermodal representationalist may lean toward answering "no" to Molyneux's question for the time being. But their view as such does not commit them to either a positive or a negative answer, and so they can wait until further progress is made in the empirical study of cross-modal calibration of quality spaces.

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