PhiMiSci
Philosophy and the Mind Sciences

Molyneux's question today. Introduction to the special issue

Gabriele Ferretti[a](fairg@live.it)
Brian Glenney[b](bglenney@norwich.edu)

Abstract
Few topics in the philosophy of perception have received more attention than Molyneux's question: *would a person with congenital blindness, able to identify cubes and spheres by touch, immediately or even eventually identify these shapes by sight alone, if made to see?* This special issue focuses on the new developments concerning the answers to this question, as well as on the new questions in the light of the results from the sciences of the mind.

Keywords
Action · Blindness · Cross-modal processing · Molyneux's question · Vision · Visual restoration

This article is part of a special issue on "Molyneux's question today", edited by Gabriele Ferretti and Brian Glenney.

The only thing worse than being blind
is having sight but no vision.
Helen Keller

(...) sapevo che di noi due
le sole vere pupille, sebbene tanto offuscate,
erano le tue
Eugenio Montale
Ho sceso, dandoti il braccio,
almeno un milione di scale

[a] University of Bergamo, Ruhr-University Bochum.
[b] Norwich University.

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947
 https://philosophymindscience.org ISSN: 2699-0369

1 One or many questions? Molyneux as a starting point for interdisciplinary research

Few topics in the philosophy of perception have received more attention than Molyneux's question: would a person with congenital blindness, able to identify cubes and spheres by touch, immediately or even eventually identify these shapes by sight alone, if made to see?

Numerous philosophers have engaged this question over its 300+ year history. Not just to find its answer, but also to provide a coherent formulation of the question, as well as to consider the related experimental evidence in order to tackle the conundrum. This very general assessment of the long history on this question is just the tip of the iceberg of a massive literature (Bruno & Mandelbaum, 2010; Connolly, 2014; Degenaar et al., 2024; Ferretti, 2017b; Ferretti & Glenney, 2020b; Glenney, 2024; Glenney, 2013; Held, 2009; Held et al., 2011; Hopkins, 2005; Jacomuzzi et al., 2003; Levin, 2008; Meltzoff, 1993; Noë, 2004; Occelli, 2014; Ostrovsky et al., 2006, 2009; Schwenkler, 2013; Sinha & Held, 2012; Smith, 2000; Van Cleve, 2014). Where do we begin?

Let's imagine a popular scenario: an angel appears before a philosopher working on Molyneux's question and offers to answer not Molyneux's question (too easy), but a question whose answer leads to a solution to Molyneux's question. What should the philosopher ask? This kind of erotetic problem (famously known within the literature, see Varzi, 2001) proves to be as difficult as answering Molyneux's question directly. For, the history of answers to Molyneux reveal that complying with one constraint may not be compatible with others.

Consider, for instance, the constraint of immediate visual identification of the shapes. Molyneux's scenario requires more than one healing miracle (Glenney & Noble, 2014).[1] First, a person with blindness must undergo a restoration of the proper functioning of the visual system so as to make the subject able to *physically* see. Second is obtaining the capacity for visual recognition so that the subject might *psychologically* (a) discriminate, (b) identify and (c) categorize the shapes by sight alone (Ferretti, 2017b). This is not easy.

But things then get complicated quickly. Even if a subject has a double-healing of this kind, to test immediate visual restoration so as to avoid any perceptual learning cannot be technically reached (Cheng, 2015). Conversely, if you want to test eventual visual object recognition, obtained through learning, you risk touch influencing the process of perceptual learning undermining the resulting shape recognition by sight (Ferretti, 2017b; Glenney, 2024). This poses several and different (1) biological, (2) experimental and (3) conceptual conundrums on the (i) immediacy, (ii) success, (iii) validity and (iv) feasibility of restoration (Ferretti, 2017b, 2019).

[1] Miracles of the kind we already know: "he spat on the ground, and made clay of the spittle, and he anointed the eyes of the blind man with the clay (6) And said unto him, Go, wash in the pool of Siloam, (which is by interpretation, Sent.) He went his way therefore, and washed, and came seeing. (7)". John, (9:5-7).

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

Philosophers and vision scientists intimately familiar with the double binds lurking behind this intricate situation often turn to a history of formulating hypothetical scenarios or paralleling questions to find a more feasible test, as well as hypothetical resolutions to the question (see Ferretti & Glenney, 2020a, for a review).

Much of the interest in Molyneux's question today is largely motivated by experimental progress in the sciences: vision science, ophthalmology, psychology, developmental science, comparative psychology, neuroscience, and related subdisciplines in the cognitive sciences. Experimental studies on cataract subjects (e.g., Chen et al., 2016; Held et al., 2011; Ostrovsky et al., 2006) are frequently considered using philosophical analysis (Schwenkler, 2013; Van Cleve, 2014; for a review, see Ferretti, 2017b; Ferretti & Glenney, 2020a). This reveals a direct interdisciplinary approach to the question, following a tradition that sees (pun intended) philosophers struggling to connect different sets of empirical evidence crucial to tackling the conundrum (Degenaar et al., 2024). In this scenario, the physical realization of what was initially just a thought experiment offers, in turn, a litmus test for our current knowledge of sensory perception, especially vision (and its relation to touch). Interestingly, experimental tests of Molyneux's question offer a roundtrip.

On the one hand, experimental progress offers new tools to engage the question. These, in turn, influence how to ask the question in a way that has philosophical value. This benefit is not trivial, given the numerous problems, both conceptual and experimental, standing in the way not only of finding a valuable answer, but also of elaborating a meaningful question, which can effectively be tested in the laboratory (Ferretti, 2017b, 2019; Ferretti & Glenney, 2020b, 2020a; Glenney, 2013).

On the other hand, an empirical test of the question can offer us a sort of metatest on our knowledge of the human mind and perception. Indeed, research on non-visual perception, on multisensory experience, as well as studies in AI vision, prosthetics and VR, can provide novel approaches to Molyneux's question, motivating new interdisciplinary research on sensory modalities, including many features of perception, and its relations to other mental states (Cohen & Matthen, 2020; see Morgan, 1977).

Now, within this jungle of problems and approaches, this special issue aims to incorporate this second research route, which is, however, also informative for the first, by including contributions that utilize Molyneux's question to discuss different topics on perception and the mind; discussions that, in turn, circle back to the possibility of answering the question. From this perspective, Molyneux's puzzle is not the finish line, so to speak, but the starting point for increasing our understanding of the senses, how they relate to each other, and to the external world.

We turn now to discuss the contributions to answering Molyneux's question found in this special issue. We address the topics each article highlights, showing the way Molyneux's question can be framed within different fields of research, not only to directly answer the question, but also to use the knowledge we gain from

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

investigating it, establishing new points of view in the sciences of perception and the mind.

2 The Contributions within this Special Issue

The contributions hosted by this special issue, as said, offer this roundtrip adventure. One first and fascinating side to explore, within the Molyneux's literature, is seemingly random cross-modal matching, such as the nonsense sounds 'boubi' and 'kiki' and correlated sights of rounded and spikey shapes first discovered a century ago by Georgian psychologist Dimitri Uznadze.

In *Old and new versions of the Molyneux question: a review of experimental answers*, Nicola Di Stefano and Charles Spence suggest that an account for these arbitrary crossmodal correspondences, first called the "new" Molyneux question by Deroy and Auvray (2013), may be what informs the "old" Molyneux's question. This requires a shift in answering Molyneux's question, which has mainly been investigated in terms of how shapes are coded in an amodal manner or what kind of perceptual learning leads to cross-modal matching. Vision and touch rely on distinct forms of processing, and also different phenomenology. This makes even more problematic the claim that the information about shape coming from visual and tactile sources can be matched at some higher level of the cognitive system, if no exposure to different stimuli in both the perceptual situations is granted. Thus, the authors conclude that, instead of focusing on Molyneux's question, we must shift to studying the cross-modal correspondences as developmental or environmental or even genetic adaptations for skills like language learning. Yet, even these studies point to a "no" answer. "Neither the developmental research, nor the latest findings from congenital cataract patients', whose sight has been restored would appear to provide any convincing evidence that such crossmodal matching can be achieved in the absence of the relevant sensory experience (i.e., as a result of associative learning/repetitive exposure)" (p. 16) This experimental shift also alleviates the theoretical burdensome context of the nativist/empiricist debate, allowing data to point the way to an answer to both the old and new Molyneux's questions.

One way to understand what demarcates the new Molyneux's from the old is its investigation of *contentless* or meaningless crossmodal correspondences. The *classic* Molyneux's problem concerns how sight and touch can be both *of* or *about* the same cube and sphere shapes. The *new* Molyneux's problem concerns the vehicles for the transfer between the senses, when and how these connections are made, and the adaptive function such connections may play. Furthermore, this new approach leads to a critique of the old Molyneux's problem: common processing of sensory "vehicles" may suggest that all shapes correspondences are *also* arbitrary, lacking common content. This possibility is taken up by Glenney (2024), who argues that both the new and old versions of Molyneux's question may rest on teleosemantic content (Millikan, 1998), where adaptive accuracy conditions between the senses tuned by local ecologies provide a basis for shared crossmodal

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

content. As Glenney concludes, "These meaningful connections are what provide conditions for when these crossmodal happenings correspond to the world and be *of* objects external to our senses in a nonarbitrary way." (Glenney, 2024, p. 131).

Another novel shift in answering Molyneux's question is picture perception or whether cross-modal correspondences are possible from a pictorial perspective. This is the central concern of Alberto Voltolini and Fabrizio Calzavarini in their paper, *A supramodal thorough account of the Molyneux question*. "If the brain is inherently capable of processing shapes in a supramodal way, a newly sighted individual might possess the neural foundation necessary to recognize 3D shapes seen for the first time, provided that the latent capabilities of their 'visual' cortex can be quickly up regulated or unmasked through exposure and experience" (p. 6). Both 3D objects and 2D pictures of objects should be immediately identifiable by the newly sighted on their "supramodal pictorial perception hypothesis" grounded on discovered overlap between visual and tactile neural cortices when processing shape input in the Lateral Occipital Complex (LOC), a potentially "supramodal" structure. In 2D pictorial perception, the central difference is figure/ground segmentation: the perceiver may struggle to identify the subject from the background. But if there are depth cues, such as occlusion, a foreground can emerge as separate from the background, and the perceiver can distinguish the picture's subject. So too with tactile pictures, such as a bas-relief: a congenitally blind subject may feel a depicted hand *as* 3D if the felt thumb blocks the feel of the occluded fingers. If sight were restored, and vision of a 2D picture of the same hand could take place, the subject would be able to recognize this same thumb-occluding-fingers hand by vision alone.

This is the first paper discussing Molyneux in the context of pictorial stimuli, and it is especially interesting, opening new debates (as there has been no attempt in answering this question), as well as perfectly fitting within the literature on the relation between picture perception and face-to-face perception (Ferretti, 2016, 2017a, 2018, 2021a; Nanay, 2011, 2017), from the perspective of perceptual learning. Indeed, we learn what a picture is, perceptually, through ontogenetic development (DeLoache et al., 1998; Pierroutsakos & DeLoache, 2003). Thus, we may use this formulation of Molyneux's question to understand perceptual learning. This motivates further questions. Would Molyneux's subjects distinguish between pictures and objects in the flesh? Or would they exhibit *pictorial blindness*?

We may also follow the literature in investigating the relation between ordinary perception, picture perception and action, for example in the case of possible Molyneux's subjects' reactions to pictorial illusions (concerning the illusory possibility of interaction) *à la trompe l'oeils* (Ferretti, 2017a, 2020a, 2020d, 2021a; Nanay, 2015). Would Molyneux's subjects treat all pictorial stimuli, at first glance, as *trompe l'oeils*? Would they distinguish between depicted cubes and spheres and the same in the flesh? What about illusory and non-illusory pictures? Would these subjects distinguish between *trompe l'oeils*, pictorial stimuli and concrete objects? *Trompe l'oeils* offer a litmus test on the relations between action, vision and touch,

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

within learning (Ferretti & Marchi, 2020, 2024). And since pictures and *trompe l'oeils* play tricks not only with *vision-for-action*, but also with *sensori-motor understanding* of perspectival aspects of the pictorial space (Ferretti, 2020a, 2020b, 2021a), we might investigate Molyneux's subjects' reactions to this perceptual fact.

Aside from particular stimuli, Molyneux's conundrum may be informative for perceptual mechanisms in healthy subjects. In this respect, it is interesting to understand whether the idea of a cross-modal matching on Molyneux subjects may tell us something about normal perceivers.

In *Newly sighted perceivers and the relation between sight and touch*, E.J. Green tackles an angle on the question that deals with establishing "a 'rational connection' between sight and touch". He focuses on two different formulations. First: are the two modalities rationally connected in *normally sighted* perceivers? Second: are they rationally connected in *all possible* perceivers? Green uses experimental evidence to tackle the second question, which is equivalent to the question of whether there's an "intrinsic similarity" between seen and felt shape. He finds that both low-level visual and tactile processing (V1/T1 and V2/T2) converges to a rational connection, all things being equal. This is further supported by high-level processing in LOC (lateral occipital complex) that treats both seen and felt shapes as equivalent, as both are "view-point invariant" such that the perspective from which one perceives the shape plays no role in its recognition. This move allows Green to consider whether perceptual experience, or the phenomenal character of perceptual experience, following Campbell (1996), depends on the external world. The paper concludes that, even if there are phenomenal differences between sight and touch, the representations of these two modalities may still be rationally connected, even *necessarily* rationally connected, "i.e., whether it is impossible for a fully reflective perceiver to perceive the same shape property through both sight and touch while coherently doubting that this is so" (p. 30).

This holds the relevance of Molyneux's question to the metaphysics of perception hostage to whether newly sighted subjects represent shapes visually. As this latter question is currently unanswerable, we may wish to ask it to our Molyneux's angel, were she to appear.

Alternatively, we may directly ask our angel whether sight and touch of shape must be rationally connected. Miraculously, we find J.J. Thomson waiting in the wings. In her 1974 paper, she argues that it is not metaphysically or logically possible for a cube to inhabit the space of a sphere and vice versa. In other words, she claims there is no world where cubes can be spheres for a fully rational perceiver. She concocts a playful scenario that may be played out in a local "metaphysical" gym (Thomson, 1974: 641). A trainer arranges both three large step cubes and three yoga balls in a triangle on the ground and presents them to a newly sighted person. The newly sighted may be confused as to which arrangement looks to be made of balls and which of cubes, but being maximally reflective, the newly sighted drops a tomato onto the middle point of each arrangement. To the trainer, the tomato will disappear in the ball arrangement, but will remain on the cube. However, this

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

may not be the case for the newly sighted: the tomato still may *look* to be on top of the ball arrangement like the cube arrangement. The trainer then carefully rolls away the spheres and pushes away the boxes. The newly sighted feels the floor under both arrangements to find the tomato only under the balls, identifying them as such, necessarily so (unless, that is, "someone picks the tomato up off the floor, carries it out to the kitchen, slices it, and eats it." (Thomson, 1974, pp. 641–642)

Still on the connections between modalities, Tony Cheng suggests, in his *Structural correspondence in Molyneux's subjects,* that Green's confidence (2022) in rational connections between the sight and feel of shapes is too strong, substituting a weaker connection based on a crossmodal, "structural correspondence." For, higher order cortices process shape in a way that can fail recognition in some cases where the perspective shifts, suggesting that the shape representations in LOC (lateral occipital complex) are view-dependent for either sight or touch. Thus, while shape representations may share the same isomorphic structures, and a one-to-one mapping between visual and tactile representations, these structures do not also possess an intrinsic similarity, as proposed by Green (2022). Cheng, thus, concludes that if we revise Molyneux's question to concern a practical test, a "multisensory knowing-how," then, his proposed structural correspondence between shapes is sufficient for a "yes" answer. "Suppose that a subject both sees and touches a specific object, and represents it as occupying certain portions of both the visual field and the tactile field. The potential spatial isomorphisms include corresponding geometries, even gestalts. The structural correspondence crucially contributes to the presumed "yes" answer to this version of Molyneux's question" (p. 10). But if this question is situated in its more common "know-that" context, the answer is inconclusive.

This angle on the problem interestingly shifts the debate from cross-modal perception to cross-modal knowledge, framing it within the literature on the relation between *practical* knowledge (knowing-*how*) and *propositional* knowledge (knowing-*that*) (for reviews, see Dickie, 2012; Ferretti, 2020c; Ferretti & Zipoli Caiani, 2021; Jung & Newen, 2010); something that will be discussed below.

Remaining within the field of the dialogue between different sense modalities, we have the article *Molyneux's question and multisensory integration*, by Berit Brogaard and Dimitria Gatzia. They are the first to focus on the relation between *sound* and touch, offering first a general Molyneux "music" question, as follows: "Would a person who was born deaf and who has learned to recognize musical sounds by touch be able to recognize musical sounds by hearing alone, if her hearing were restored?" (p. 6)

Now, *ça va sans dire*, the literature on cross-modal matching in perception and cognition is the theoretical queen before whom Molyneux's question deposes its accomplishments. Molyneux's question allows us to understand the relation between the senses, and provides a battle-ground for the disputes among philosophers, ophthalmologists and vision scientists. At the same time, the novel evidence on cross-modal processing also allows us to understand not only the value, but also

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

the problems with the question, as well as many other problems on this processing, precisely starting from the question. The received view, attributed to O'Callaghan (2012), argues that bound multimodal perceptual content lacks any sense-specific content, and is replete with amodal content in higher-order areas of the brain.

Brogaard and Gatzia take the received view to task utilizing a novel "speaking" form of Molyneux's question. Imagine a deaf person who can read lips has their hearing partially restored—they can hear sounds but not localize them. Imagine they hear a scandalous story being told at a party where many people are talking; could they match the look of lip movements with the story to identify the scandalous storyteller? Brogaard and Gatzia predict success, supported by recent experimental work. They take the received view to task for its supposed "no" answer, which assumes that the newly hearing would require full restoration, including the ability to also localize the sound by hearing. For, on the received view, the contents of sight and sound must match fully in order to combine amodally. This hypothetical scenario promotes a distinctive way of answering Molyneux's problem that does not require amodal non-sensory content, but only matching sensory content. One concern for Brogaard and Gatzia's multimodal answer is that it obscures a fundamental issue raised by Molyneux: whether perception is inherently multisensory—whether perception is *of* or *about* external objects full stop rather than the sensory information used to perceive the objects. Their answer might be satisfied by mere crossmodal correspondences of the sensory information itself. After all, there's no fundamental connection between sounds and mouth movements, *per se*—several different mouth movements may generate the same sound given the other conditions for sounds involved in speaking.

This concern is raised by Altieri's (2024) recent paper that argues that a necessary condition for answering Molyneux's problem is an account of a common coded vehicle that can be triggered by visual stimuli alone—a commonly coded vehicle that is accessible to sight alone that might trigger access to the multimodal content. The ability to perceptually link visual and auditory (and tactile) experiences may be insufficient to answer Molyneux's problem without an account of an innate or "hardwired" access to processes involved in visual recognition.

Aside from the problems on the possibility of cross-modal matching, perception is usually a source of knowledge, and then we may ask about the knowledge status, gained from perception, of Molyneux subjects.

In *Molyneux's question about perceptual knowledge,* Mohan Matten and Jonathan Cohen consider an *epistemic* variation of the usual Molyneux question that stems from Molyneux's very first version (1688), "whether this man could know which was the globe". They suggest that the *epistemic question* is more stringent than the standard version first published by Locke in 1693, "about whether a newly sighted man could distinguish a globe and a cube when they are presented to his sight alone" (p. 1). Knowing a cube or a sphere may not even be perceptual due to various contingencies of specific sensory experiences that have little to do with the cube or sphere itself. The demands on the senses are

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5.* https://doi.org/10.33735/phimisci.2024.11947

thus greater, and entail some degree of sensory skill. The *epistemic formulation* of the question demands an "*active sensory exploration*" of the shapes. Thus, rather than merely focusing on perceptual *processing* in the born blind subject, the question asks about perceptual *knowledge*, which was originally also proposed by Molyneux (1688). In other words, the answer to the question "What does it take to know by visual perception [...] which was the cube and which the globe?" (p. 12) involves reference to *sensory exploration.* The authors suggest that the questions on perceptual knowledge, as those on perceptual processing, will require empirical investigation. This perspective opens an interesting path towards an investigation about the relation between concepts, knowledge, and perception, in case of sensory deprived subjects, which is highly informative also for healthy perceivers.

This angle is highly informative for the debate on knowledge and the dynamic, active aspects of perception (see also below). We may consider, in this context, the relation between sensory exploration and perceptual beliefs, with respect to propositional knowledge. I can propositionally know that there is a cube before my eyes, I can visually perceive there is a cube before my eyes, and I can have a motoric understanding about how I may interact with this cube (as well as motoric knowledge from interacting with this), these being different aspects of experience. Indeed, it has been suggested that "The concept of shape, for instance, is represented in a multiplicity of areas: shape is a geometrical property but also requires a motor knowledge (and a motor experience, possibly acquired during development) to be fully defined" (Fadiga et al., 2000: 176).

A most distinctive aspect of this epistemic rendering is the time required to visually engage in active sensory exploration of the shapes: where to look and how to interpret what one sees beyond the visual-specific sensory array. Alternatively, the ability of blind painters to depict visual scenes with astonishing accuracy provokes the question of how *seemingly* visual knowledge is acquired without sight, and whether this could contribute to their success of visually knowing a shape if given sight.

Crucially, the notion of *active sensory exploration* also recalls the idea that perception and action are deeply bound. This leads to consider formulations concerning action (Ferretti, 2017b, 2019, 2020b; Gallagher, 2005, 2020).

In his *Molyneux and motor plasticity*, Shaun Gallagher precisely starts from a formulation of the question (Gallagher, 2005) asking not just whether the subject would recognize the shapes, but whether she would properly interact with them (a question also proposed by Jacomuzzi et al., 2003, following the history of the original question, in relation to reaching).

This proposal fueled a subsequent debate. Indeed, Ferretti (2017b) considered whether the subject could properly grasp the shape, based on what we know from the *Two visual systems model*, which suggests that the hodology of the visual system sees (pun intended) two visual pathways, one dorsal path for visually guided-action, and one ventral path for object recognition. A question further analyzed

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

by Gallagher (2020), considering different stimuli for the action or motoric version of the question, and by Ferretti (2020b), suggesting considering motor imagery, to push the question a step forward (in relation to other accounts on Molyneux and imagery, see Nanay, 2020).

In his paper, Gallagher proposes an elegant closure of the circle, which he himself built within the literature, by investigating not visual plasticity, the usual target of Molyneux, but motor plasticity. He considers enactive responses to Molyneux's question, such as Noë's (2004), whose "yes" answer was based on learning of sensorimotor contingencies concerning the knowing-how that vision relies on when full recovery is obtained. However, Gallagher suggests, "Noë's argument is worked out without mention of neural plasticity" (p. 8). Starting from this, Gallagher contends that "In the context of the Molyneux question, whenever plasticity has been discussed, it has been limited to plasticity in the sensory areas – especially in the visual cortex […]" (Ibid.). He "suggest[s] that the enactive approach should make us consider plasticity in the motor areas – or more specifically, the complex plasticity involved in sensory-motor integration areas" (Ibid.). Gallagher considers the role of the dorsal pathway and explains that 'sensori-motor-knowing-how' will take days, differently from the ventral pathways, which requires 48 hours. Then, Gallagher suggests formulating the action question with respect to sensori-motor contingencies. This would allow us to better understand motor integration and/or re-calibration. The conclusion is that "By pursuing the Molyneux question we end up with more questions than answers" (p. 12), and this counts when considering motoric plasticity, recovery of sensori-motor-processing's knowing-how and calibration vs. coordination.

This enriches the philosophical discussion on action and Molyneux, in the light of empirical results (Chen et al., 2016; Senna et al., 2022). This circles back on Cheng's proposal, interesting in the light of both Gallagher's, and Matthen and Cohen's proposal, as well as of a recent revival on the debate between knowing-*that* and knowing-*how* (again, for reviews, see Dickie, 2012; Ferretti, 2020c; Ferretti & Zipoli Caiani, 2018, 2021; Jung & Newen, 2010). Furthermore, Cheng's angle potentially shifts the debate on the motor version of Molyneux's question one step further, proposing to consider the answer on the basis of the kind of knowledge we are taking into account, whether *practical* or *propositional*, opening up debates between perceptual concepts, motor concepts and language, in relation to represented shapes in these subjects, an interesting perspective in the light of recent discoveries on action language in blind subjects (Tomasello et al., 2024).

Taken together, the angle on pictures and the perspective on action in Molyneux's subjects shed light on the different dimensions of vision (2D pictorial stimuli, vs. 3D objects in the flesh, in comparison to middle objects as *Trompe l'oeils*) and their relation to action, with respect to possible questions on cross-modal matching.

For example, the visual processing of stereopsis is crucial both for the recognition of 2D objects from 3D objects, as well as in successful action guidance (Fer-

retti, 2016, 2021b, 2023, forthcoming a, forthcoming b; Vishwanath, 2014, 2022). Here is an interesting question. Would Molyneux's subjects display *stereoblindness*, wherein lack of stereopsis causes lack of 3D vision, leading subjects to perceive a two-dimensional world that does not offer the impression of interaction anymore, and invites difficulties in visually guided motor interaction? (Ferretti, 2021b, forthcoming b). That is, among the aspects of blindness that these subjects undergo, would there be any problem with stereopsis? If so, and if this would impair the experience of motor interactability, they could be considered as *motorically blind*, affected by a sort of *motoric blindness*, that is, blindness to the relevant visuo-spatial aspects for the impression of motor interaction usually displayed by objects (Ferretti, forthcoming a, forthcoming b).

But cross-modal matching in action is also crucial for our experience of the external realty. In this respect, as Molyneux's subjects provide a case for when perception is broken, there are also subjects providing a case for when the sense of reality is broken. This is the case of patients with derealization, i.e., an impairment in the feeling of reality. Interestingly, we may also conceive a Molyneux's subject with *derealization* (cfr. Ferretti, forthcoming a, forthcoming b)[2], to investigate the relation between vision, action, touch and the experience of an external, mind-independent reality (Ferretti, 2023, 2024, forthcoming a), in the light of recent evidence on how touch and vision impact on the sense of reality (Fairhurst et al., 2018).

Finally, we can consider an *ecological* approach, *à la* Gibson (Gibson, 2014), one of the most quoted within the embodied perspective on cognition (Ferretti & Zipoli Caiani, 2024), to Molyneux's question (see Fulkerson, this issue, and Gallagher, this issue). Could Molyneux's subjects perceive affordances? (Ibid.) And following *enactivist* conceptions of the question (Noë, 2004), would the subject perceive sensorimotor contingencies (cfr. Gallagher, this issue)? Different notions on the relations between vision and action can be investigated, not only in imagining and formulating potential questions, but also in running the tests (Ferretti, 2017b; Schwenkler, 2013), by recognizing how vision is bound to action (and *vice versa*, see Ferretti & Zipoli Caiani, 2021, 2024). For example, *via vision-for-action*, behind the notion that *vision guides action* (Ferretti, 2017b), or *via sensorimotor understanding*, behind the notion that *vision is a form of action* (Noë, 2004); two notions that, again, are also crucial in considering our capacity to distinguish between pictorial objects, objects in the flesh and *trompe l'oeils*, *via* action (Ferretti, 2020a, 2020d, 2021a).

This approach is also extremely precious in the light of recent evidence on animal cases of *Molyneux in action* (Glenney, 2024). In a set of recent experiments on newly hatched chicks, Versace et al. (2024) showed that known visual "imprinting" learning abilities of chicks is possible by touch as well such that if chicks tactilely imprint on specific pointy features, they will identify pointy features by sight alone

[2] Gabriele Ferretti thanks Shaun Gallagher for suggesting the possibility of analyzing this case during a conference.

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

and ignore smooth features. These chick behaviors based on vision alone demonstrate the ability to answer a modified "animal" version of Molyneux's question that is freed from verbal-based identification, one-off experiment (there were over 100 chicks used), and static presentation of objects, as chicks were allowed to move about the object features and identify objects by their behavior. Accordingly, over 50 animal species from every class reveal various crossmodal perceptual abilities, even in non-human senses, including ants, bats, crabs, dolphins, electric fish, frogs, goats, horses, among others (for a review, see Glenney, 2024).

So far so good. We've been talking about possible formulations of the question that are precious for generating novel questions, in the light of what the original question teaches us about cross-modal perception and its relation to other rooms within the mind. But the most problematic aspect of Molyneux's question is that, provided we can formulate a meaningful version of it, we need answers. Several of the above papers point in the direction of pluralism, also showing its problems.

In his *many Molyneux answers: why we shouldn't care (that much) about the answers to Molyneux's question*, Matthew Fulkerson takes a completely different direction with respect to other authors. Instead of investigating novel formulations of the question, he just suggests that the answers to the question are not relevant, as the question is too general, and the ways in which it can be spelled out may conflict with each other. Even so, answering the questions requires numerous assumptions, and this does not allow asking a specific question. Not even an experimentally successful shape matching resolves the problem.

Fulkerson follows the account by Ferretti (2017b), Glenney (2013), and Cohen and Matthen (2020), Matthen and Cohen (2020), all pointing to the fact that there may be not a unique question, but different questions, all resting on different assumptions, and thus invoking different potential answers. In this scenario, "A lot of work needs to be done to make clear which version would be tested, and then of course there are all the methodological worries about getting the experiments and data collection right" (p. 8). On the same line: "It is thus empirically plausible that even for researchers focused only on a more specific version of MQ, they could reasonably come to different answers depending on where they draw the lines around touch and vision, and how they theorize about the taxonomic boundaries between the senses and non-sensory elements like emotion, cognition, and motor control" (pp. 10-11). Thus, for Fulkerson, the question is highly theory-laden, i.e., dependent upon which aspect we are examining, and which commitment we are endorsing toward notions such as vision, representation, cognition, *et similia*. Thus, even going pluralistic (Ferretti & Glenney, 2020b, 2020a) does not help the investigation, i.e., pluralism does not make it more legitimate.

Perhaps, however, Molyneux's question teaches us a big lesson. The ambiguity caused by the question's under-specification can be taken as motivation to formulate a kind of pluralism that thrives in such chaos. After all, there are more under-specified problems than Molyneux's question that are quite pressing and demand solution, from climate change, political progress, and gender to more ab-

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

stract questions of the nature of deity(s) and even aliens (or at least UAPs). (All in all, tackling Molyneux's conundrum, thus, offers a *theoretical gym*, again, to face these tricky questions emerging from all fields of life). In this respect, it is not a "solution" to Molyneux that may matter, but rather a methodology for Molyneux-type questions, ambiguous and under-specified, that may matter and, incidentally, eventually lead to a resolution.

This is the very task of Glenney's (2024) recent book, *A Pluralist's Guide for Solving Molyneux's Problem*. Utilizing an enhanced version of Dennett's three stances or levels of explanation, Glenney presents a more robust analysis of how Molyneux's question has developed and can be understood:

1) *Intentional Stance*: what is believed about an answer to Molyneux's question.

2) *Intentional Design Stance*: adding conditions and variations to design Molyneux's question to support that belief.

3) *Teleological Design Stance*: hypothesizing models and theories of the mind to account for how that believed answer (1) fits our design of the question (2).

4) *Physical Stance*: empirically deriving models of the brain that provide the most salient evidence for our hypothesized model of the mind (3).

Various answers to Molyneux's problem over its 300+ year history, including those in this special issue, can be located on distinctive levels of explanation and then built into a "plug and play" system for a more explanatory answer to Molyneux, a model Glenney brands as "synthetic" in its connective strategy across various disciplines, rather than "analytic" or reductive.

That said, another lesson coming from the different strategies to tackle the question is that, when looking at the future, we cannot forget the past. This is what the analysis by Silvia Parigi reminds us, in her *"O God of Newton and Clarke, have mercy on me!": Nicholas Saunderson, Denis Diderot and the only possible answer to Molyneux's question*. Parigi suggests that Diderot's answer to Molyneux revolutionized its study by attending to aspects inherent but previously undiscussed in the question that are now commonly debated today: the epistemic conditions of the newly sighted as distinct from the empirical studies that both support and offend answers, both past and present. After a brief overview of both "no" and "yes" answers to Molyneux by such luminaries as Berkeley and Leibniz, Parigi considers the proto-pluralist or "relativistic" solution by Diderot, whose solution is subject to the experimental conditions of specific subjects. In particular, Diderot's answer is a "yes" if based on the blind Cambridge mathematician Nicholas Saunderson who became blind at the age of 1 and was an expert in geometry and optics: if tested, Saunderson *would* identify the cube from the sphere shapes. By contrast, Diderot reasons that Cheselden's uneducated boy, blind from birth, no doubt *must* fail to identify the shapes due to his ignorance of geometry. In sum, we agree with Parigi that Diderot's recognition of specific differences in subjects must be included in

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

any well-formed answer to Molyneux for, "1) it depends on the conditions under which the experiment is conducted; 2) it depends on the blind person: his story, training, previous skills, experience, knowledge and culture; 3) it depends on the experimenter: his sensibility, training and philosophical biases. This apparently skeptical answer seems the only possible one" (p. 14).

Accordingly, Diderot's answer anticipates a new criticism of Molyneux's problem that goes a step further than Fulkerson's complaint of under-specification to its under-individuation. This critical point is made in a recent paper by Nanay (2020), who argues that there exists a variety of visual imagery abilities in blind subjects, which may lead to successful visual identification of shapes in some, while failure in others. This demand to individualize answers is further motivated by recent work on the condition of blindness that reveals its multifarious nature: there is no general kind that can be called "blind." Rather, there are a myriad of different kinds of blindnesses, and each promotes distinctive kinds of "at first sight" experiences (Fine & Park, 2018). In fact, it may be that for some blindness is not an absence of sight, but a different sight. "Blindness is not simply 'less' vision, it is an *other vision*" (Cattaneo & Vecchi, 2011, p. 206).

Interestingly, Pierrès, in his paper *Jackson, Diderot and the round and red cherries*, agrees with Parigi about the importance of Diderot's answer, while applying it to the related famous problem by Frank Jackson of "Mary's Room", reorienting Molyneux's problem around the *qualia* problem. Recall Mary, a brilliant color scientist who, lacking any color experience, sees color for the first time and, perhaps, learns something new about color. Would Mary also fail to distinguish red from green at first sight of these colors? In other words, does the subjectivity of a first-person color experience that seems beyond the conceptual one apply to the concepts of color to enable the distinguishability of red and green? Do the same intuitions that apply to shape apply to color as well? The insight of Pierrès Jackson's paper is to then consider Diderot's essay as a key source for an analogy. Saunderson, a brilliant shape scientist (geometer) lacks any visual experience of shape and, according to Diderot, *would* be able to distinguish simple shapes like circles and squares. By contrast, a person with blindness who lacked knowledge of geometry would not distinguish shapes. Pierrès reasons that such a conclusion may transfer to distinctions of color. "The qualitative aspect is not separate from the quantitative; rather, they are intertwined. (p. 12)" While first person color experiences cannot be quantified, the ability to distinguish between two color experiences by a color expert like Mary may be!

The context of color expertise and its relationship to shape expertise provides a revealing context for a "Rubik's cube" variant of Molyneux's problem: might a newly sighted person solve a colored Rubik's cube at first sight by color-matching, when previously only having solved when blind by Braille-matching? (Glenney, 2024). Solving a Rubik's cube at first sight entails that the subject might have the ability to distinguish colors even though they lack color experitise. However, since the colors themselves do not need to be identified by name, their distinctions serve

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

more as signs for how to strategically rotate the cube sides. Might a Rubik's cube color side matching facilitate the success of a puzzler's expertise in that way that geometry facilitated Saunderson's square and circle identification ability? A "yes" answer may find support from Voltolini and Calzavarini insightful "supramodal pictorial perception hypothesis," as kinetic tactile engagement with object surfaces appears to result in automatic crossmodal connections with sight.

In a more specialized discussion of the history of Molyneux's question, Anna Vaughn's paper discusses, *Locke's architecture of ideas and the failure of the newly sighted: an answer to Molyneux's question*. Locke's answer to Molyneux is perhaps discussed more frequently than Molyneux's question itself because it seems like Locke *should* answer "yes." For one, Locke explicitly claims that shape is a primary quality of objects known equally by sight and touch. In a sense, Locke's answer *must be* yes if it is in answer to Molyneux's own understanding of his question as about how the senses correspond to shape. Locke's own understanding of Molyneux's question is otherwise; it is about how experience and learning are necessary for the newly sighted to identify 3D shapes. But even on this rendering Locke should answer 'yes' as shape is a simple idea, which we are made aware of upon sensory stimulation. Locke even declares that identifying an idea like 'round' is "infallible" and will occur "at first sight (IV. i. 2)." It is here where Vaughn produces clear evidence that awareness of simple ideas for Locke requires a complex cognitive architecture. For one, the faculty of "discernment" or "judgment" may be susceptible to errors if defective (II. xi. 12) or if produced under poor conditions (II. xi. 2), both of which are exemplified by Molyneux's man born blind. As Vaughn concludes, "thus, there is more than one reason why a newly sighted person would fail to identify what she sees for the first time (p. 4)." Hence, an abnormal visual faculty will produce a diminished or altered simple idea of shape, perhaps a sphere will appear as a "circle variously colored," particularly in comparison to a well-functioning tactile faculty which first acquired the sphere idea.

In his *Representationalism and Molyneux's question: an intermodal approach based on quality space theory*, Daniel Weger defendes "representationalist" theories of perception that claim that the phenomenal character of perceptual experiences are exhausted by their content against problems associated with crossmodal perception. Essentially Weger accepts the challenge laid at the feet of representationalism earlier by Gendler and Hawthorne (2006) that "when we perceive something as circular by touch and perceive something as circular by vision, the phenomenology is radically different but the property represented is the same." (Gendler & Hawthorne, 2006: 19) Weger identifies several ways that the representationalist might argue for visual and tactile phenomenal differences for some shape S: 1) there are intramodal representational differences dependent on different senses, 2) there are intermodal representational differences dependent on different representations based on their acquisition by different senses. Weger's preference is for (2), but this demands an account of sense-specific representational content. To do so, he appropriates Rosenthal's "quality space" account for ordering and catego-

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

rizing properties of objects, or at least provides, "a representationalist reading of [quality space] that can be adopted by the proponent of intermodal representationalism." (p. 12) Thus, just as orange is more like red than green, an ellipse is more like a sphere than a cube. This works for intermodally distinct representations: a visual sphere is more like a tactual sphere than a visual cube, an ordering that figures in to the way these representations are categorized and thereby utilized for identifying objects in the world.

Weger's move is not without significant questions: are these quality space orderings innate or learned? After all, if we have a radically heterogeneous view of the senses like Berkeley where touch is directly spatial and vision is lacking in any spatial significance, then it may be that these orderings *could* result in a tactile cube being more like a tactile sphere than a visual cube.

Galiano-Landeira's paper, "*Molyneux's answer: Situated predictive processing*", frames the question within the predictive processing approach, a well-established theory of the brain (Friston, 2009; Hohwy, 2013), and presents one possible learning mechanism that may account for Held et al.'s studies. According to this theory, the brain is a prediction machine ("predictive processing") and the body is a device for sampling the world (cognition is 4E: embodied, embedded, enacted, and extended) to construct the most predictive model in a system-world interaction for the best "situated prediction" (for a review, see Ibid.). Thus, prior to having sight, a congenitally blind person might have a multisensory structured representation of the world with touch, sound, and smell to guide their distal engagement with future world experiences. On this view, new visual experiences like the one Molyneux predicts, will at first lack any representational influence over the generative models and be "clueless" in associating the look of shapes to their prior tactile experiences. This "no" answer, in more precise terms reads that "The system would, therefore, assign low precision to the priors from the visual modality and would refrain from making uncertain predictions, instead placing greater weight on the buttom-up sensory information" (p. 22). However, since there is a reliable generative model that is already multimodal, the inclusion of vision should be accepted rapidly by having embodied or "real world" experiences to generate a larger associative model, adding higher precision to the already high tactile priors. In a word, Held et al.'s data that results in a "no" but soon "yes" answer to Molyneux appears to support a situated predicting brain-body machine.

Might Galiano-Landeira's arguments be applicable to the "new" Molyneux problem discussed by Di Stefano and Spence? Is there a situated predictive link between non-sense sounds like "bouba" and round visual stimuli? Or to unrelated sensory intensities, like the loudness of sound and brightness of light? Whatever the answer, situated prediction provides a methodological guide for escaping binary theories like nativism vs. empiricism, allowing a focus on the diversity of potential strategies that the brain and the body utilize for adaption to its varying ecology. Both new and old Molyneux's problems find a common point of departure in developmental and genetic bases of crossmodal perception that

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

work together to make sense of the world through predictive modelling. This is extremely interesting in the light of a recent communion between theories of predictive processing on the one hand, and embodied and enactive theories on the other (for a review, see Kirchhoff, 2018).

3 Conclusion

What question might we ask our Molyneux's angel? Which area of study might promote the greatest advance on answering Molyneux's question? If this *Special Issue* is any guide, we must continue a plurality of investigations to make progress on answering Molyneux by way of numerous specializations and levels of explanation. No single piece of empirical data will solve Molyneux's conundrum, nor any specific theory. Rather, Molyneux's question requires a generative pluralism to integrate these various specializations into a unified account. To this Molyneux's angel, wherever you are, we ask only how might we unite these seemingly disparate data points within theories to provide a uniquely robust answer to Molyneux. Or give us sight to see the bi-stability of seemingly contradictory "yes" and "no" answers at different levels of explanation.

Acknowledgments
We thank all the authors for being part of this wonderful special issue. We also thank Michael Pohl for his precious assistance, and Sascha Benjamin Fink for showing interest toward this project. Gabriele Ferretti would like to acknowledge support from a Humboldt Fellowship, hosted by Professor Albert Newen, at the Institute for Philosophy II, Ruhr-University Bochum, Germany.

References

Altieri, N. (2024). Is Molyneux's question really about multisensory integration? *Journal of Theoretical and Philosophical Psychology*. https://doi.org/10.1037/teo0000270

Bruno, M., & Mandelbaum, E. (2010). Locke's answer to molyneux's thought experiment. *History of Philosophy Quarterly*, *27*(2), 165–180.

Campbell, J. (1996). Molyneux's question. *Philosophical Issues*, *7*, 301–318.

Cattaneo, Z., & Vecchi, T. (2011). *Blind vision: The neuroscience of visual impairment*. MIT Press.

Chen, J., Wu, E.-D., Chen, X., Zhu, L.-H., Li, X., Thorn, F., Ostrovsky, Y., & Qu, J. (2016). Rapid integration of tactile and visual information by a newly sighted child. *Current Biology*, *26*(8), 1069–1074. https://doi.org/10.1016/j.cub.2016.02.065

Cheng, T. (2015). Obstacles to testing Molyneux's question empirically. *I-Perception*, *6*(4), 1–5. https://doi.org/10.1177/2041669515599330

Cohen, J., & Matthen, M. (2020). What was Molyneux's question a question about? In G. Ferretti & B. Glenney (Eds.), *Molyneux's Question and the History of Philosophy* (1st ed., pp. 325–344). Routledge. https://doi.org/10.4324/9780429020377-29

Connolly, K. (2014). Multisensory perception as an associative learning process. *Frontiers in Psychology*, *5*.

Degenaar, M., Lokhorst, G.-J., Glenney, B., & Ferretti, G. (2024). Molyneux's problem. In E. N. Zalta & U. Nodelman (Eds.), *The Stanford Encyclopedia of Philosophy* (Summer 2024). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/sum2024/entries/molyneux-problem/

DeLoache, J. S., Pierroutsakos, S. L., Uttal, D. H., Rosengren, K. S., & Gottlieb, A. (1998). Grasping the nature of pictures. *Psychological Science*, *9*(3), 205–210. https://doi.org/10.1111/1467-9280.00039

Deroy, O., & Auvray, M. (2013). A new Molyneux's problem: Sounds, shapes and arbitrary crossmodal correspondence. *SHAPES*, 61–70.

Dickie, I. (2012). Skill before knowledge. *Philosophy and Phenomenological Research*, *85*(3), 737–745. https://doi.org/10.1111/j.1933-1592.2012.00638.x

Fadiga, L., Fogassi, L., Gallese, V., & Rizzolatti, G. (2000). Visuomotor neurons: Ambiguity of the discharge or "motor" perception? *International Journal of Psychophysiology*, *35*(2-3), 165–177. https://doi.org/10.1016/S0167-8760(99)00051-3

Fairhurst, M. T., Travers, E., Hayward, V., & Deroy, O. (2018). Confidence is higher in touch than in vision in cases of perceptual ambiguity. *Scientific Reports*, *8*(1), 15604. https://doi.org/10.1038/s41598-018-34052-z

Ferretti, G. (2016). Pictures, action properties and motor related effects. *Synthese*, *193*(12), 3787–3817. https://doi.org/10.1007/s11229-016-1097-x

Ferretti, G. (2017a). Are pictures peculiar objects of perception? *Journal of the American Philosophical Association*, *3*(3), 372–393. https://doi.org/10.1017/apa.2017.28

Ferretti, G. (2017b). Two visual systems in Molyneux subjects. *Phenomenology and the Cognitive Sciences*, *17*(4), 643–679. https://doi.org/10.1007/s11097-017-9533-z

Ferretti, G. (2018). The neural dynamics of seeing-in. *Erkenntnis*, *84*(6), 1285–1324. https://doi.org/10.1007/s10670-018-0060-2

Ferretti, G. (2019). Molyneux's puzzle: Philosophical, biological and experimental aspects of an open problem. *Aphex, Open Problems*, *19*.

Ferretti, G. (2020a). Do *trompe l'oeils* look right when viewed from the wrong place? *The Journal of Aesthetics and Art Criticism*, *78*(3), 319–330. https://doi.org/10.1111/jaac.12750

Ferretti, G. (2020b). Action at first sight. In G. Ferretti & B. Glenney (Eds.), *Molyneux's Question and the History of Philosophy* (1st ed., pp. 284–299). Routledge. https://doi.org/10.4324/9780429020377-26

Ferretti, G. (2020c). Anti-intellectualist motor knowledge. *Synthese*, *198*(11), 10733–10763. https://doi.org/10.1007/s11229-020-02750-9

Ferretti, G. (2020d). Why *trompe l'oeils* deceive our visual experience. *The Journal of Aesthetics and Art Criticism*, *78*(1), 33–42. https://doi.org/10.1111/jaac.12688

Ferretti, G. (2021a). Why the pictorial needs the motoric. *Erkenntnis*, *88*(2), 771–805. https://doi.org/10.1007/s10670-021-00381-1

Ferretti, G. (2021b). On the content of peripersonal visual experience. *Phenomenology and the Cognitive Sciences*, *21*(3), 487–513. https://doi.org/10.1007/s11097-021-09733-2

Ferretti, G. (2021c). A Distinction Concerning Vision-for-Action and Affordance Perception. *Phenomenology and the Cognitive Sciences*, *21*(3), 487–513. https://doi.org/10.1007/s11097-021-09733-2

Ferretti, G. (2023). For an epistemology of stereopsis. *Review of Philosophy and Psychology*. https://doi.org/10.1007/s13164-023-00711-y

Ferretti, G. (2024). Understanding reality and presence in dreams through imagery. *Analysis*, anae025. https://doi.org/10.1093/analys/anae025

Ferretti, G. (forthcoming a). Philosophical implications of derealization disorder. *Synthese*. Forthcoming.

Ferretti, G. (forthcoming b). What stereoblindness teaches us about visual reality. *Phenomenology and the Cognitive Sciences*. Forthcoming.

Ferretti, G., & Glenney, B. (2020a). General introduction to Molyneux's question and the history of philosophy. In G. Ferretti & B. Glenney (Eds.), *Molyneux's question and the history of philosophy* (pp. 1–27). Routledge.

Ferretti, G., & Glenney, B. (2020b). *Molyneux's question and the history of philosophy*. Routledge.

Ferretti, G., & Marchi, F. (2020). Visual attention in pictorial perception. *Synthese*, *199*(1-2), 2077–2101. https://doi.org/10.1007/s11229-020-02873-z

Ferretti, G., & Marchi, F. (2024). *Trompe l'oeil illusions: Pay (visual) attention!* Argumenta. https://doi.org/10.14275/2465-2334/20240.FER

Ferretti, G., & Zipoli Caiani, S. (2018). Solving the interface problem without translation: The same format thesis. *Pacific Philosophical Quarterly*, *100*(1), 301–333. https://doi.org/10.1111/papq.12243

Ferretti, G., & Zipoli Caiani, S. (2019). Between Vision and Action. Introduction to the Special Issue. *Synthese*. https://doi.org/10.1007/s11229-019-02518-w

Ferretti, G., & Zipoli Caiani, S. (2021). How knowing-that and knowing-how interface in action: The intelligence of motor representations. *Erkenntnis*, *88*(3), 1103–1133. https://doi.org/10.1007/s10670-021-00395-9

Ferretti, G., & Zipoli Caiani, S. (2024). An all-purpose framework for affordances. Reconciling the behavioral and the neuroscientific stories. *Synthese*, *Special Issue: Neuroscience and Its Philosophy*. https://doi.org/10.1007/s11229-024-04646-4

Fine, I., & Park, J.-M. (2018). Blindness and human brain plasticity. *Annual Review of Vision Science*, *4*(1), 337–356. https://doi.org/10.1146/annurev-vision-102016-061241

Friston, K. (2009). The free-energy principle: A rough guide to the brain? *Trends in Cognitive Sciences*, *13*(7), 293–301. https://doi.org/10.1016/j.tics.2009.04.005

Gallagher, S. (2005). *How the body shapes the mind* (1st ed.). Oxford University PressOxford. https://doi.org/10.1093/0199271941.001.0001

Gallagher, S. (2020). No yes answers to Molyneux. In G. Ferretti & B. Glenney (Eds.), *Molyneux's Question and the History of Philosophy* (1st ed., pp. 235–249). Routledge. https://doi.org/10.4324/9780429020377-21

Gendler, T. S., & Hawthorne, J. (Eds.). (2006). *Perceptual experience*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199289769.001.0001

Gibson, J. J. (2014). *The ecological approach to visual perception: Classic edition* (1st ed.). Psychology Press. https://doi.org/10.4324/9781315740218

Glenney, B. (2024). *A pluralist's guide to solving Molyneux's problem* (1st ed). Taylor & Francis Group.

Glenney, B. R. (2013). Philosophical problems, cluster concepts, and the many lives of Molyneux's question. *Biology & Philosophy*, *28*(3), 541–558. https://doi.org/10.1007/s10539-012-9355-x

Glenney, B., & Noble, J. T. (2014). Perception and prosopagnosia in Mark 8.22-26. *Journal for the Study of the New Testament*, *37*(1), 71–85. https://doi.org/10.1177/0142064X14546079

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

Green, E. J. (2022). Representing shape in sight and touch. *Mind & Language*, *37*(4), 694–714. https://doi.org/10.1111/mila.12352

Held, R. (2009). Visual-haptic mapping and the origin of cross-modal identity. *Optometry and Vision Science*, *86*(6), 595–598. https://doi.org/10.1097/OPX.0b013e3181a72999

Held, R., Ostrovsky, Y., De Gelder, B., Gandhi, T., Ganesh, S., Mathur, U., & Sinha, P. (2011). The newly sighted fail to match seen with felt. *Nature Neuroscience*, *14*(5), 551–553. https://doi.org/10.1038/nn.2795

Hohwy, J. (2013). *The predictive mind*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199682737.001.0001

Hopkins, R. (2005). Molyneux's question. *Canadian Journal of Philosophy*, *35*(3), 441–464. https://doi.org/10.1080/00455091.2005.10716598

Jacomuzzi, A. C., Kobau, P., & Bruno, N. (2003). Molyneux' question redux. *Phenomenology and the Cognitive Sciences*, *2*(4), 255–280. https://doi.org/10.1023/B:PHEN.0000007370.68536.2d

Jung, E.-M., & Newen, A. (2010). Knowledge and abilities: The need for a new understanding of knowing-how. *Phenomenology and the Cognitive Sciences*, *9*(1), 113–131. https://doi.org/10.1007/s11097-009-9129-3

Kirchhoff, M. (2018). Predictive brains and embodied, enactive cognition: An introduction to the special issue. *Synthese*, *195*(6), 2355–2366. https://doi.org/10.1007/s11229-017-1534-5

Levin, J. (2008). Molyneux's question and the individuation of perceptual concepts. *Philosophical Studies*, *139*(1), 1–28. https://doi.org/10.1007/s11098-007-9072-5

Matthen, M., & Cohen, J. (2020). Many Molyneux questions. *Australasian Journal of Philosophy*, *98*(1), 47–63. https://doi.org/10.1080/00048402.2019.1603246

Meltzoff, A. N. (1993). Molyneux's babies: Cross-Modal perception, imitation, and the mind of the preverbal infant. In A. N. Meltzoff (Ed.), *Spatial representation* (pp. 219–235). Blackwell.

Millikan, R. G. (1998). A common structure for concepts of individuals, stuffs, and real kinds: More Mama, more milk, and more mouse. *Behavioral and Brain Sciences*, *21*(1), 55–65. https://doi.org/10.1017/S0140525X98000405

Morgan, M. J. (1977). *Molyneux's question: Vision, touch and the philosophy of perception*. Cambridge University Press.

Nanay, B. (2011). Perceiving pictures. *Phenomenology and the Cognitive Sciences*, *10*(4), 461–480. https://doi.org/10.1007/s11097-011-9219-x

Nanay, B. (2015). Trompe l'oeil and the dorsal/ventral account of picture perception. *Review of Philosophy and Psychology*, *6*(1), 181–197. https://doi.org/10.1007/s13164-014-0219-y

Nanay, B. (2017). Threefoldness. *Philosophical Studies*, *175*(1), 163–182. https://doi.org/10.1007/s11098-017-0860-2

Nanay, B. (2020). Molyneux's question and interpersonal variation in multi-modal mental imagery among blind subjects. In G. Ferretti & B. Glenney (Eds.), *Molyneux's question and the history of philosophy* (pp. 257–263). Routledge.

Noë, A. (2004). *Action in perception*. MIT Press.

O'Callaghan, C. (2012). Perception and multimodality. In E. Margolis, R. Samuels, & S. P. Stich (Eds.), *The oxford handbook of philosophy of cognitive science* (pp. 92–117). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195309799.013.0005

Occelli, V. (2014). Molyneux's question: A window on crossmodal interplay in blindness. *Rivista Internazionale Di Filosofia e Psicologia*, *5*(1), 72–101. https://doi.org/10.4453/rifp.2014.0006

Ostrovsky, Y., Andalman, A., & Sinha, P. (2006). Vision following extended congenital blindness. *Psychological Science*, *17*(12), 1009–1014. https://doi.org/10.1111/j.1467-9280.2006.01827.x

Ostrovsky, Y., Meyers, E., Ganesh, S., Mathur, U., & Sinha, P. (2009). Visual parsing after recovery from blindness. *Psychological Science*, *20*(12), 1484–1491. https://doi.org/10.1111/j.1467-9280.2009.02471.x

Pierroutsakos, S. L., & DeLoache, J. S. (2003). Infants' manual exploration of pictorial objects varying in realism. *Infancy*, *4*(1), 141–156. https://doi.org/10.1207/S15327078IN0401_7

Schwenkler, J. (2013). Do things look the way they feel? *Analysis*, *73*(1), 86–96. https://doi.org/10.1093/analys/ans137

Senna, I., Piller, S., Ben-Zion, I., & Ernst, M. O. (2022). Recalibrating vision-for-action requires years after sight restoration from congenital cataracts. *eLife*, *11*, e78734. https://doi.org/10.7554/eLife.78734

Sinha, P., & Held, R. (2012). Sight restoration. *F1000 Medicine Reports*, *4*. https://doi.org/10.3410/M4-17

Smith, A. (2000). Space and sight. *Mind*, *109*(435), 481–518. https://doi.org/10.1093/mind/109.435.481

Thomson, J. J. (1974). Molyneux's problem. *The Journal of Philosophy*, *71*(18), 637. https://doi.org/10.2307/2024801

Tomasello, R., Carriere, M., & Pulvermüller, F. (2024). The impact of early and late blindness on language and verbal working memory: A brain-constrained neural model. *Neuropsychologia*, *196*, 108816. https://doi.org/10.1016/j.neuropsychologia.2024.108816

Van Cleve, J. (2014). Berkeley, Reid, and Sinha on Molyneux's question. In D. J. Bennett & C. S. Hill (Eds.), *Sensory Integration and the Unity of Consciousness* (pp. 193–208). The MIT Press. https://doi.org/10.7551/mitpress/9780262027786.003.0009

Varzi, A. C. (2001). The best question. *Journal of Philosophical Logic*, *30*(3), 251–258. https://doi.org/10.1023/A:1017549407042

Versace, E., Freeland, L., & Emmerson, M. G. (2024). First-sight recognition of touched objects shows that chicks can solve Molyneux's problem. *Biology Letters*, *20*(4), 20240025. https://doi.org/10.1098/rsbl.2024.0025

Vishwanath, D. (2014). Toward a new theory of stereopsis. *Psychological Review*, *121*(2), 151–178. https://doi.org/10.1037/a0035233

Vishwanath, D. (2022). From pictures to reality: Modelling the phenomenology and psychophysics of 3D perception. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *378*(1869), 20210454. https://doi.org/10.1098/rstb.2021.0454

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947

Ferretti, G., & Glenney, B. (2024). Molyneux's question today. Introduction to the special issue. *Philosophy and the Mind Sciences*, *5*. https://doi.org/10.33735/phimisci.2024.11947