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Recommended Citation

Mitchell, R.W. *Biol Philos* (2015) 30: 137. doi:10.1007/s10539-013-9403-1

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Biology & Philosophy

ISSN 0169-3867

Volume 30

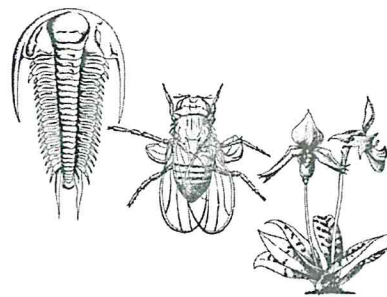
Number 1

Biol Philos (2015) 30:137-144

DOI 10.1007/s10539-013-9403-1

Volume 30 · Number 1 · January 2015

**BIOLOGY &
PHILOSOPHY**



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A critique of Stephane Savanah's "mirror self-recognition and symbol-mindedness"

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Received: 25 November 2012 / Accepted: 23 October 2013 / Published online: 17 November 2013
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Abstract Stephane Savanah (Savanah Biol Philos 28:657–673, 2013) provides a critique of theories of self-recognition that largely mirrors my own critique (though without recognizing it) that I began publishing two decades ago. In addition, he both misconstrues my kinesthetic-visual matching model of mirror self-recognition (MSR) in multiple ways (though he appears to agree with the actual model), and misconstrues the evidence in the scientific literature on MSR. I describe points of agreement in our thinking about self-recognition, and criticize and rectify inaccuracies.

Keywords Mirror self-recognition · Kinesthetic-visual matching · Association · Children · Apes

Stephane Savanah's (2013) "Mirror self-recognition and symbol-mindedness" purports to provide a "new argument in favour of the view that MSR shows self-awareness by examining the nature of the mirror image itself" (p. 657). The new argument is that the mirror self-image is a symbol for the self-observer, who thus has a concept, which requires self-awareness [see Piaget's (1945/1962) strikingly similar ideas]. Savanah employs MSR to support his theory; I don't, but accept that MSR indicates some form of self-awareness regardless of the theory's accuracy (Mitchell 1993a, 2002a). What Savanah presents about MSR is not new and is sometimes inaccurate.

Savanah (p. 665) presents my kinesthetic-visual matching (KVM) explanation for MSR as associative, tying my ideas to Heyes's, who would be surprised (cf. Heyes 1996; Mitchell 1996). According to the KVM explanation, prior to recognizing

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themselves in the mirror, organisms can match feelings of their body's movement and shape (kinesthesia; also called somathesis, proprioception: Mitchell 2010) to visual images that show the same movement and shape (Mitchell 1993a, b, 1997a, b, 2002b). Such matches can occur in MSR, in recognition that one is being imitated, and in some forms of pretense about and bodily imitation of others (Mitchell 1993a, b, 2012a). Associationist models do not depend on matching between perceptions. KVM is a mentalistic explanation of MSR, rather than (as Savanah, p. 664, states) a "non-mentalistic interpretation." KVM explains how the organism initially recognizes its image in the mirror as an image of its body: using KVM, I "explain how organisms recognize *for the first time* that the image in the mirror is an image of their own body, by describing mental representations (nonvisual self-images as well as other cognitive operations) which are present *before* the creation of a mirror-based visual-self-representation" (Mitchell 1993a, pp. 296–297).

Savanah and I agree that associationist models cannot explain MSR. We agree, for all the same reasons, that Gallup's approach, in which MSR indicates complete self-awareness, is false. We agree about there being multiple levels of self-awareness, and about the complicated relationship, developmental and otherwise, between MSR and theory of mind. We recognize the need for longitudinal studies of MSR and its relationship to other psychological capacities, though Savanah appears unaware of such studies (Courage et al. 2004; Keller et al. 2005; Nielsen et al. 2003; Nielsen and Dissanayake 2004). We agree (Savanah p. 665; Mitchell 1993a, p. 296) that organisms with KVM also have what we both call "visual-visual matching" (VVM), though I point out that VVM is present in most mammals and birds, and in humans well before MSR. Indeed, I require that organisms recognize the visual correspondence between things outside the mirror and mirror images (except their own body), which I call "understanding of mirror correspondence" (UMC), if we are to use evidence from the mark test as evidence of MSR (Mitchell 1993a, 2007). Organisms that do not recognize themselves in a mirror can recognize the similarity between "their own" arm and the visual arm in the mirror (in that they experience them both as arms attached to bodies and as visually similar), and experience the fusion between the kinesthetic and visual experiences of their own arm, such that neither fact, alone or together, can account for MSR (Mitchell 1993a, 2007, 2010; though see complications in Mitchell 2002a, 2010, 2012a). Codifying one's arm as "one's own" is unlikely without KVM (Mitchell 2010, 2012b).

Like Savanah, I view MSR as requiring concepts about the self (including symbolization and representation) that have wide-ranging implications for the recognizer's psychology (Mitchell 1994a, b, 2010). Once organisms recognize themselves, they have a self-representation, as I explicitly noted (e.g., Mitchell 1993a, p. 314; Mitchell 1997a, p. 33), contrary to Savanah's (p. 666) claim. According to Savanah (p. 664),

Mitchell (1997a, b) claims that MSR could be better explained by kinaesthetic-visual matching rather than the ascription of a self-concept to chimpanzees. This argument is intended to show that a subject passing the mark test might only be recognising its own body. Since all organisms can differentiate self from non-self, passing the mark test might thus represent

nothing more than this type of 'own-body recognition' with no concept of the self involved.

Inaccuracies abound. (1) The KVM used to recognize oneself in a mirror is clearly conceptual, and results in a self-concept (i.e., a self-representation; Mitchell 1993a, 2002a, 2010, 2012a). (Psychologists usually use the term "self-concept" to indicate extensive knowledge about and diverse attitudes toward the self—Oyserman et al. 2012, p. 72.) Specifically, my 1997a paper (cited by Savanah) argued against Gallup's self-concept model, *not* against *any and all* self-concepts being present in organisms with MSR. Thus, in Mitchell (1997a, p. 33), I state that the KVM model "predicts a very limited self-representation" in contrast to Gallup's "self-concept" model which attributes to a self-recognizing organism knowledge of all aspects of its "self." (2) My argument is, thus, clearly *not* "intended to show" that the animal is "only" recognizing its own body. Once an organism can do so, a variety of other psychological possibilities may arise, including imaginal planning and theory of mind (e.g., Mitchell 1993a, 1994a, b). (3) Recognizing one's own body is hardly the same as differentiating self from non-self. Like Savanah (p. 664), I clearly distinguish organisms' skill at differentiating self from non-self (present in most animals) from their having a concept of self (Mitchell 1994a). Thus, it is beyond understanding how the self present in the differentiation of self from non-self could possibly be the same self as that present in passing the mark test; if they *were* the same, all organisms that differentiate self from non-self should pass the mark test!

Matching confuses Savanah (p. 665). Recognizing a match between two things does not require that one believe that they are identical in every aspect; I can recognize that one thing is here and another, there, and still recognize a match between them, and I can do so without believing that they must, because matching, be in the same location. In inaccurately critiquing the KVM explanation, Savanah (p. 665) notes that, "as only its [the organism's] *actual* body parts match the sensations of proprioception [i.e., kinesthesia], and as the mirror image is distal and unconnected, it [the organism] acquires the knowledge that the mirror image is only a *representation* of its actual body." But if it were the case that "only" the *actual* body part matches the organism's kinesthetic sensations, then how could KVM (i.e., matching the organism's kinesthetic experiences to its visual image in the mirror) even begin to operate? It would be impossible! The organism would be forever unable to recognize that feelings of the movement and shape of its body parts are similar to the visual images of the movement and shape of its body parts. The fact that we recognize that someone is imitating our facial gestures, or know what our hands' movements look like without looking at them, indicates that Savanah is wrong: we can match our kinesthetic feelings to similar forms in the visual modality, and vice versa. Savanah's attack here on the idea that one can match one's kinesthetic feeling of one's own body and visual images in the mirror is especially strange because, on p. 661, he asserts that some animals might fail to pass the mark test because they "miss any opportunity to grasp the relation between mirror image and somesthetic sensations." This "relation" must, presumably, be the match between somesthesia (i.e., kinesthesia) and vision—KVM! The relation must be more than mere contingency, as young humans and even monkeys, all of whom fail

to show MSR, are aware of contingency between actions and mirror-images (Mitchell 1993a, 2012a).

Although Savanah (p. 665) assumes that the KVM explanation requires that kinaesthesia is “associated” with visual experiences of one’s body, the fusion commonly experienced between kinesthesia and visual aspects of one’s body may be an innate “given” that develops through moving one’s body, and that changes with the body (Mitchell 1994a). Kinesthesia is easily mapped to variations in one’s own body, as when amputees who see a claw attached to their arm stub feel kinesthetically that their hand is now in the shape of a claw (Mitchell 1994a, 2010). Additionally, even without a visual exemplar, we can say what a kinesthetic experience looks like—as when amputees feel a phantom limb in a given shape they have never seen, or when you move your fingers behind your back into various configurations. Whether the match between kinesthesia and the visual image in the mirror is developed through “association,” as Savanah (p. 665) assumes, is unknown (Mitchell 1997a). Cross-cultural work suggests that greater parental contingent responsiveness toward infants induces earlier MSR (Keller et al. 2004). Thus, the age at which children pass the mark test is not universal, but depends on early experiences.

Given that I acknowledge that, once MSR occurs, there is a self-representation, Savanah misrepresents my ideas when he states that they fail to account for whether the organism showing MSR “takes the mirror image as its *actual* (physically extended) body, or as a *representation* of the body” (p. 665). In separating these two conceptually distinct interpretations of the mirror-image, Savanah fails to recognize that both can be present in the same organism. It is *not* the case, as Savanah (p. 665) asserts, that “only its *actual* body parts match the sensations of proprioception” (i.e., kinesthesia). When using a mirroring representation of our body, we can sometimes experience ourselves as “over there” where we see ourselves in the mirroring image; this typically occurs in situations in which we use our hand, which is not directly perceptible but is (apparently) visible via a mirror or video, to find something. In these situations, the relationship between our hand and the thing to be found is presented to us in mediated form through a mirror or video image (Mitchell 2010). In such situations, it is *not*, as Savanah (p. 665) argues, that “the actual arm’s position in space ... is accompanied by proprioception, not the mirror image”, specifically because people can *misidentify* their arm. People *feel* kinesthesia (proprioception) where they *think* their arm is, rather than where it actually is. Savanah argues, misunderstanding matching, that “The movements of (say) an arm and the arm’s identical mirror image will be perfectly synchronized and *both* simultaneously visible. [Thus] Any visual matching of kinaesthesia going on is more likely to correspond to the sight of the primate’s actual arm moving in the (non-mirror) visual field rather than its mirror image” (p. 665). Savanah is correct that, normally, an animal that can see its visual arm would feel kinesthesia in that arm (Mitchell 1993a, p. 297), and can see visual correspondences between the arm in the mirror and that arm attached to its body (as noted above). However, why any of this recognition of similarity or matching would *stop* the animal from recognizing that what the arm feels like kinesthetically matches *both* the visual image in the mirror *and* the direct visual image of its own arm is unclear, as is why it would be

more likely to recognize such a match in its direct experience than in the mirror image.

More importantly, Savanah fails to recognize that the mark test requires that the animal *cannot* directly see its own appendages, such that neither VVM, nor the inherent match between one's own (actual) appendages and kinesthesia, can explain MSR (Mitchell 1993a). That's why the mark is placed on the face, and not the arm, to test for MSR; and that's why a standard criterion for MSR other than the mark test is self-exploration using the mirror to see *parts otherwise not visible* (Mitchell 1993a, p. 295, 2012a, pp. 660–663). (Indeed, the first ape known to show MSR was a wild-born gorilla, who examined her teeth via a mirror—Mitchell 2012a, p. 656). This requirement, that the animal use the mirror to act upon its body, is why it is hard to believe that the organism who recognizes itself, based on these standard criteria, believes that it itself is in the mirrored space (rather than where it actually is), and also is why the KVM explanation does not predict that this is so.

Thus, when Savanah writes, “I agree that the kinaesthetic-visual matching argument implies the organism recognises the mirror image as *its own body*, but the point I want to emphasise is that it [the organism] does not acknowledge the image as part of its *physical body*,” he clearly misses the point of what KVM is explaining. KVM requires that the organism recognize that its kinesthetic feelings are *like* what it sees in the mirror, which images *look similar* to what its kinesthesia *feels like*, not that the organism recognize that its kinesthetic feelings are *in* the (virtual) body that it sees in the mirror. In essence, if the organism is using kinesthetic-visual matching to pass the mark test, the organism must recognize that the mirror-image is providing information about its physical body, and must not believe that the mirror-image is showing where its physical body is located (i.e., behind the mirror). If the organism believes that its actual body is behind the mirror, why does it touch its own face to remove the mark? It should, instead, attempt to reach into mirrored space. Analogously, when KVM is used to explain bodily imitation or recognition of being imitated, the organism imitating or being imitated (to redeploy Savanah's words) does not acknowledge the visual image of the other as part of its *physical* body. Nor should it, as KVM shows: it just needs to recognize a match between the kinesthetic form of its body and another's visually experienced body.

Passing the mark test may be insufficient evidence of MSR. What counts as “passing the mark test” varies (Mitchell 2002a, 2012a), and both children's and apes' responses to their mirror-image following successful mark-test performance suggest that complete understanding of the mirror image as representing the self is not assured. Some children and apes pass the mark test, yet look behind the mirror afterward (Mitchell 1993a, p. 305); human infants sometimes wipe away a mark on their own face that they see on another's face, be it another child or their mother (a point noted as problematic in Mitchell 1993a, p. 304). Savanah (p. 662) mentions this objection but claims it is irrelevant by showing that infants recognize that images of objects they see in the mirror can be found outside it; he then notes that this responsiveness occurs *before* these children attain MSR. Consequently, this evidence is irrelevant to the objection: a child might respond to a mark on its nose that it sees on the nose of the (virtual) child it sees in the mirror without thinking that the (virtual) child is a self-representation.

Children's understandings of mirrors are important for another reason. That children and other organisms prior to MSR understand that mirrors reflect visual images of objects—other than the organisms themselves—is the basis for my assumption that UMC is required, in addition to KVM, for these organisms to recognize themselves (Mitchell 1993a, pp. 298–299; 2007). In UMC, infants and other organisms recognize that mirrors reflect accurate and contingent images of objects (other than themselves) in front of mirrors. Clearly UMC requires VVM if organisms are to recognize that objects *outside* the mirror are “the same” as ones that are apparently *inside* it. Thus, contrary to Savannah's implication (p. 666), my model takes into account that organisms must have VVM in order to show MSR. Oddly, many organisms that can use mirrors to find things don't seem to use mirrors to “find” themselves. If VVM were all that was needed to show MSR, many mammals and birds should show MSR.

The reason I believe that MSR is an indication of self-awareness is that MSR depends upon KVM, which allows the organism to translate between visual images of itself doing things in mental imagery and kinesthetically felt enactments of this imagery. If the organism has a visual self-image and it can imagine that self-image doing things, because of KVM it can turn what it imagines itself doing in visual imagery into its own actions, because it knows what these imaginal visual self-images feel like kinesthetically. With KVM, the organism can, thus, *plan* to do things by imagining itself doing things, and then do them (Mitchell 1994b, 2002b). Without KVM, the organism could not translate between visual self-images and kinesthetic feelings. Without KVM, organisms cannot recognize themselves in a mirror (though for alternatives: Mitchell 1993a, 2012a), and thus any *visual* self-image would be relatively impoverished. Once MSR occurs, organisms' KVM and self-representation may ramify psychologically, developing into deeper understandings of other minds (Mitchell 1994b, 2000, 2012b).

Some minor points: Calling apes “phylogenetically more advanced” than monkeys is problematic, as neither phylogeny nor evolution is essentially progressive (Hodos and Campbell 1969). Several gorillas show MSR via the mark test and other means (Mitchell 2012a), and a wild-born gorilla was the first ape to show MSR. Bonobos have never been tested via the mark test, but provide other evidence of MSR, and lesser apes also show MSR; evidence about monkeys is peculiar and confusing (Mitchell 2012a). Given the negative correlation between frequency of parental contingent responsiveness and age of MSR in children, perhaps variations in parental contingent responsiveness, rather than methodological issues, cause variations in MSR across species (though methodological variations in what counts as “passing the mark test” make comparisons within and across species difficult—Mitchell 2002a, 2012a). Contrary to implications that passing the mark test is all-or-none, variation abounds in evidence of MSR via passing the mark test (as well as via other means) during individual children's development (Courage et al. 2004). Proximal explanations for development of MSR (and KVM) suggest that one's experiences, including those prepackaged and provided by others in one's community, influence development of one's conceptualizations (Keller et al. 2005; Piaget 1945/1962). Analogically, theorists attempting to develop new conceptualizations about a topic might benefit from attending more elaborately to previous work.

Acknowledgment I appreciate the good humor with which Stef Savanah read my critique and responded to emails.

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