Social learning in the non-social: imitation, intentions, and autism

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Want and Harris's target article provides a useful service by delineating several social learning mechanisms that, in developmental psychology, are often confused as imitation proper. Such confusion can lead to conceptual and theoretical difficulties where there need not be any. Though there is much of interest to comment on in this paper, I will restrict my focus to one such confusion encountered by a recent study on imitation and autism published in the pages of this journal (Aldridge, Stone, Sweeney & Bower, 2000).

Autism is an interesting population to look at in this case because they have documented difficulties with imitation. Indeed, impaired imitation is among the DSM-IV and ICD-10 diagnostic criteria for autism. Difficulties with both imitation and theory of mind invite a link between these abilities, as has been suggested by several authors (Meltzoff, 1990; Meltzoff & Gopnik, 1993; Rogers & Pennington, 1991). Melzoff and Gopnik (1993) see early imitation as providing 'the first, primordial instance of infants making a connection between the visible world of others and the infant's own internal states' (p. 337). A disturbance in recognizing the connection between one's own movements and the movements of others, on their view, results in an impaired social development, including theory of mind abilities. Similarly, Tomasello (1999) suggests that chimpanzees and some autistic children fail to make this 'like me' connection, which in his model is required for understanding that others (and the self) have intentions.

As examples of mimicry or 'blind' imitation, goal emulation and imitation proper, Want and Harris discuss the studies of Meltzoff (1988, 1995) and a follow-up study by Carpenter, Nagell and Tomasello (1998), among others. Carpenter *et al.* replicated Meltzoff's (1988) initial finding that 14-month-old children would imitate the strange act of turning a light on with their heads. They also found that children between 9 and 13 months would repeat this action, though they were less likely than the older children to check if their actions resulted in the light going on. Thus, the behavior of the older children is seen as imitation proper, as they were attentive to both the means and the goal, while the behavior of the younger children, because they did not attend to the goal, is seen as mimicry or 'blind' imitation. Similarly, Meltzoff's (1995) oft-cited studies on imitating unfulfilled intentions (e.g. pulling apart dumbbells) are, according to Want and Harris's breakdown, not imitation but rather 'goal emulation', because the actual (failed) actions were not copied.

So how might we expect preverbal autistic children to perform at such tasks? As mentioned, the clinical literature notes a deficit in imitation and the cognitive literature notes a deficit in understanding other minds. Aldridge *et al.* (2000) recently ran some of these 'unfulfilled intentions' tasks and found, much to their surprise, that the autistic children (mean age = 39 months) did very well indeed. Moreover, none of the autistic children ($n = 10$) succeeded on any of the gestural imitation tasks (e.g. tongue protrusion, wiggling ears with both hands). According to Meltzoff and Gopnik's (1993; Meltzoff, 1990) model, gestural or bodily imitation is a developmental precursor to the more computationally demanding procedural imitation as found in the 'unfulfilled intention' studies, though a core mechanism is shared between the two abilities. Aldridge *et al.* find it difficult to support this model in light of their findings, despite their best efforts.

There are many ways to look at this issue, only a few of which I'll address here. First, we might consider these findings as evidence against Meltzoff and Gopnik's theory, as we now have an apparent existence proof of what they consider to be a more complex form of imitation in the absence of an ability upon which it was theorized to rely. This also casts some doubt as to the relation between theory of mind and imitation, as hypothesized by several models. But according to Want and Harris, the 'unfulfilled intentions' tasks do not measure imitation proper, but rather goal emulation, and need not reflect a shared mechanism with imitation, in contrast to Meltzoff and Gopnik's claims. On the other hand,

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the apparent absence of gestural/bodily imitation leaves open the possibility that this form of social learning may be connected to mentalizing abilities and social cognition more generally, though its relation to goal emulation is in question.

Want and Harris note that because stimulus/local enhancement and emulation learning are ruled out as mechanisms in instances of bodily imitation, such behaviors must reflect either imitation, mimicry or goal emulation. Mimicry or 'blind' imitation is seen often in autism, as evidenced by high instances of echolalia. Goal emulation is apparently seen as well, as mentioned above. If such learning mechanisms are intact in autism, then perhaps their lack of bodily imitation reflects an ability to imitate proper. Yet considering an act such as tongue protrusion imitation proper (which includes taking into account means and goals) seems to be quite a stretch, particularly if this ability is available to neonates. So which social learning mechanism is deficient in autism, and how do we account for their success at goal emulation and apparent absence of bodily imitation?

Aldridge *et al.* are quite puzzled by their findings, particularly because they believe that the procedural imitation tasks are an index of mental state attribution capabilities – specifically regarding the ability to infer the 'intentions' of another. To pass this task, however, a child (or chimp) need not be thinking about what another is thinking. The standard behaviorist move would be to replace 'intention' to do such and such with 'attempt' to do such and such, thus avoiding some of the philosophical baggage of the mentalistic term 'intention'. Moreover, studies of this kind do not separate the different but related notions of desire, goal and intention. We could just as naturally say that the children inferred the actor's unfulfilled desire, goal or attempt to change the state of affairs. Phillips, Baron-Cohen and Rutter (1998), in a study designed to teased apart the notions of desire and intention, found that autistic children had considerable difficulty distinguishing between fulfilled and unfulfilled intentions and desires, though the task was admittedly more difficult than the imitation tasks mentioned above, even for normally developing children.

Expecting or inferring a non-existent state of affairs need not require the ability to posit goals, intentions or desires. Young infants 'expect' objects to appear from behind occluders, for instance, though no one is prepared to say that these children attribute to the object the 'goal' of emerging from the occluder, or the 'desire' to come to rest after hitting the floor. It is quite possible that the actions performed on the objects in the procedural imitation studies may have been enough to trigger expectations about a future state of affairs without the need for any mentalistic notions (or imitation) whatsoever.

Finally, and quite importantly, Aldridge *et al.* did not carry out the 'light box' task, which Want and Harris point out as a good example of imitation. However, this task was carried out with older autistic individuals (mean age = 11 years) by Charman and Baron-Cohen (1994). Interestingly, though the performance of these individuals was near ceiling on both the gestural/bodily and procedural imitation tasks, they had considerable difficulty with the 'light box' task. Charman and Baron-Cohen suggest that because this task cannot be passed by a goal-oriented solution, '[t]his task may therefore be a better test of true imitation than the other procedural tasks employed, which may have inherent goal-directedness and which may thus be solved without recourse to imitation' (p. 410). This claim fits well with Want and Harris's breakdown, who consider the 'light box' task to be true imitation and the other procedural tasks to better reflect goal emulation.

Thus, autism provides a curious and interesting profile for the examination of social learning mechanisms. Each of the learning mechanisms mentioned by Want and Harris seems to be intact in certain tasks yet absent in others. An attempt to employ their helpful and much needed breakdown of learning mechanisms to the autistic case reminds us of a constant trouble-spot in the study of cognition: the same behavior need not reflect the same learning mechanism.

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All forms of social learning are not created equal

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Over the past few years, social or observational learning procedures have been used extensively to study memory development in infants and young children. Although this work was not originally designed to examine the issues outlined by Want and Harris (this issue), studies from a number of different laboratories shed new light on the mechanism by which infants and young children acquire new behaviors through watching and repeating the actions of others.

The observational learning procedure used in my laboratory was modeled on the procedure originally developed by Meltzoff (1985). Several features of this procedure circumvent the interpretive problems outlined by Want and Harris in their review of the developmental literature. For example, the infants in our studies are never given the opportunity to touch the stimuli prior to the demonstration or to practice the target actions prior to the test (for review, see Barr & Hayne, 2000). The test period is also very brief; infants are typically given only 60–90 seconds from the time that they first touch the test stimuli to produce the target actions. These features of the procedure increase the probability that infants' performance during the test reflects observational learning *per se*, rather than simple trial and error. Furthermore, in some studies, the experimenter demonstrates a 3-step sequence of behaviors using a single set of objects (e.g. Barr, Dowden & Hayne, 1996; Herbert & Hayne, 2000a, 2000b). In other studies, the experimenter demonstrates a single action with a series of different objects (e.g. Collie & Hayne, 1999; Hanna & Meltzoff, 1993; Klein & Meltzoff, 1999; Meltzoff, 1988a, 1988b, 1995). Both procedures allow us to examine age-related changes in children's ability to acquire complex, goal-directed behavior on the basis of observation alone.

Most studies of social learning by human infants have used the term 'imitation' to refer to the mechanism by which observers acquire new behavior through observation. Want and Harris argue that at least three other social learning phenomena (local enhancement, stimulus enhancement and mimicry) must be ruled out before we can conclude that imitation has occurred. As outlined in the target article, *local enhancement* refers to an increase in observers' interest in the location at which they have seen another individual perform an action or actions; s*timulus enhancement* refers to an increase in observers' interest in a particular object that they have seen another individual using. In both instances, observers learn nothing about the model's actions. In the case of *mimicry*, on the other hand, observers are thought to learn something about the model's actions, but to acquire little or no understanding of the relation between those actions and the outcome they produce.

A small arsenal of studies has now shown that infants' ability to learn through observation is not restricted to local enhancement, stimulus enhancement or mimicry. In the course of our work using observational learning

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