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Review

Perspectives on Imitation: From Neuroscience to Social Science

edited by Susan Hurley and Nick Chater.

Cambridge, MA; London: The MIT Press, 2005.

Volume 1 Pp. 456 and Volume 2 Pp. 568.

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Imitation can be said to have enjoyed something of a renaissance in recent years. Once considered to be a low-level behaviour of little interest, its elevation in status sets it beside other capacities thought to be crucial to the human mind, such as language and understanding others' minds. Indeed, some would argue that imitation is prior to language and mind-reading in evolutionary terms or in children's development (Donald, 2005; Meltzoff, 2005; Rizzolatti and Arbib, 1998). Additionally, the discovery that people imitate others in day to day life without being conscious of it suggests that this behaviour is much more pervasive than previously assumed (Chartrand and Bargh, 1999). This has raised questions as to what role imitation plays both in the development of individual children and in society at large.

It is in this context that Susan Hurley and Nick Chater have brought together researchers from a wide range of disciplines to tackle the subject on a number of different levels, from the underlying neural mechanisms, through possible evolutionary roots and the development of imitation in human infants, to the roles that imitation might play in adult life and society. The two volumes of *Perspectives on Imitation* are characterised by genuine debate and disagreement and significant space has been allowed for commentaries on the chapters, both by the other authors and by various other researchers. Many of the commentaries are on chapters outside the authors' own disciplines and this has the effect of opening the discussion in a way that is accessible, as well as stimulating genuinely interesting questions and fresh suggestions for further research.

Each volume is subdivided into two sections. *Mechanisms of Imitation* and *Imitation in Animals* are contained in Volume 1, and *Imitation and Human Development* and *Imitation and Culture* are dealt with in Volume 2. This categorisation does not restrict the discussion, however, as many of the contributions range beyond strict disciplinary boundaries.

Mechanisms of Imitation broadly deals with the evidence from neuroscience for mirror neurons in monkeys and mirror circuits in humans. In the first two chapters, Rizzolatti and Iacoboni discuss the experimental evidence for mirror neurons in the F5 premotor area of the macaque brain. These neurons fire in response to the sight (and sometimes sound) of an action, such as paper being torn, but also fire when the monkey itself performs such an action. This discovery has been greeted with excitement as mirror neurons seem to provide a neural basis for the correspondence problem in imitation – that is, how the perception of another's action can be translated into the motor production of the same act by the self. Functional brain imaging studies support the existence of a related mirror circuit in humans. Rizzolatti, Iacoboni, Decety and Chaminade discuss converging findings from studies utilising a range of designs and imaging technologies that show that simply watching another's actions leads to activity in the motor areas of the brain. These include positron emission tomography (PET) evidence of premotor activation while watching hand movements, electromyography (EMG) studies showing covert activity in facial muscles while viewing facial expressions, and single neuron recording from patients which identified cells that responded when the patient experienced pain and also when they watched the same stimulus being applied to another.

Interpretation of mirror neurons, however, is not straightforward. Though it is tempting to assume that they hold the key to how imitation occurs, we should remember that macaques, in which mirror neurons were first identified, do not actually imitate. One line of thought is that mirror neurons allow *understanding* of others' actions by mapping them onto motor plans for similar actions performed by the self. This corresponds with the motocentric theory of perception which, as Claxton points out in Volume 2, 'keeps being forgotten and rediscovered' (Vol. 2, p. 199). Mirror neurons may code for others' actions in the same way that canonical neurones seem to code for objects' affordances. These neurons fire in response to the sight of an object, and when the monkey uses a grip congruent with that object. Gallese further develops this idea by arguing that the nervous system codes for *relations* between the organism and the world in a way that fulfils the need to control interactions with the world and with other organisms. Kinsbourne suggests that this *enactive coding* is the only way that preverbal infants (and presumably animals) can meaningfully represent the world.

Gallese develops the concept of a blended intersubjective space, where the self and other are represented in the same terms. As part of the identification of conspecifics it narrows the 'meaning space to be mapped' (vol. 1, p. 103), though does not necessarily imply mental identification. This is, initially, 'intersubjectivity without subjects' (vol. 1, p. 105) as it is only with development that infants are able to differentiate self from other and develop into conscious subjects. Gordon gives the example of contagious crying and suggests that it is only with time that infants are able to establish that it is not personal distress that lies behind *that* crying (from another). Jones agrees that this view of mirror neurons as part of a mechanism for 'automatic, subpersonal, nonpropositional recognition and understanding of the actions of others' (vol. 1, p. 206) may lay the basis for the understanding of intentions that is, in turn, necessary for imitation. In sum, it seems likely that mirror neurons are necessary but not sufficient for imitation.

In *Imitation and Human Development*, Kinsbourne depicts imitation as integral to attachment in infants through providing a way to entrain to others' behaviour. This is, in part, prompted by the need to explain the findings of Meltzoff and others that appear to show rudimentary imitative behaviour in new-born human infants. Meltzoff, in a chapter in the same section, characterises this as an innate ability that is purposive, effortful, and allows infants to develop an understanding of others' mental states through relating the other's facial expression to the mental state that the infant is in when showing the same expression. However, Anisfeld questions Meltzoff's findings by arguing that the

only 'imitated' gesture that there has been convincing evidence for is tongue protrusion, suggesting that this may not represent actual imitation. Elsner makes the observation that this behaviour seems to have more in common with neonatal reflexes, such as stepping and grasping, which disappear a few weeks after birth to reappear later in a form that is under greater voluntary control. If this is the case then imitative-like behaviour in neonates may be qualitatively different from imitation later in infancy, serving different purposes. This early behaviour may play a role primarily in attachment, in the way that Kinsbourne suggests. While later imitation also has a strong social component, it often plays a more instrumental role in allowing children to learn from others. It is not currently known if these two facets of imitative ability are continuous with each other or have different developmental trajectories.

The section entitled *Imitation in Animals* covers some fascinating research that may shed some light on imitation in different contexts. Byrne describes the seeming ability of wild apes to copy sequences of actions needed to prepare certain foods, such as gorillas feeding on nettles. Whiten, Horner and Marshall-Pescini have demonstrated that captive chimpanzees can learn to extract food from a complex artificial fruit by selectively copying a particular technique. Byrne makes the point that apes may be able to parse sequences of actions into modules based on statistical regularities in others' behaviour, but that module boundaries may be most clearly marked by changes to the object. For example, when learning how to process nettles young gorillas may note the changes in the nettle leaves, rather than the details of the other's hand positions. Anyone who has ever tried to learn origami will probably have relied on similar clues, copying the transformations of the paper and not the other person's hands. Jones observes that apes only seem to imitate to gain food, whereas imitation is intrinsically rewarding to human children. These comparisons suggest that imitation in humans and other primates may be qualitatively different in some ways.

How can we use this evidence for imitation in other species to understand the emergence of mirror neurons during brain development? Are they innately specified or do they arise through experience? Heyes, in a chapter entitled *Imitation by Association*, argues that learning to imitate may not be qualitatively different from learning in other cognitive domains. In Heyes' model, mirror neurons are formed through frequent pairing of sensory stimuli with motor actions. In monkeys, this could occur when animals watch their own hands while foraging for food, as the visual stimuli will always correspond with the action being carried out. The similarity between the monkey's hand and that of other monkeys or humans mean that mirror neurons will then fire in response to the sight of others' hands as well. This mechanism, not specific to mirror neurons, could account for the emergence of other neuron types. For example, canonical neurons, which seem to code for objects' affordances, link the visual perception of an interesting object to the type of grip likely to be used during manual exploration of the object.

On this learning account, the correspondence between perception and action necessary for imitation of actions that are invisible to the individual performing them, such as facial imitation in humans or imitation of beak versus foot actions in birds, may rely on the presence of conspecifics that are frequently engaged in the same behaviour. In humans, the tendency of parents to imitate their babies during the first few months of life has been documented across different cultures (Jonsson, *et al*, 2001), and mirrors are often available. Though Heyes doesn't suggest a parallel mechanism for avian species, engaging in feeding behaviour while being surrounded by conspecifics behaving the same way may allow similar associations to be formed. The lateral position of pigeons' eyes, for example, creates a 300 degree plus panoramic field of view meaning that surrounding birds are likely to be easily viewed during feeding (Holden and Low, 1989; Martin, 1984).

Whiten asks that if imitation is this easy to learn, then why is it not seen widely in the animal kingdom? One possibility is that there are innate perceptual, attentional or motivational biases specific to humans (perhaps seen to some degree in apes) that predispose to this type of learning. At the very least, a propensity to attend to others' faces, to engage in periods of face-to-face interaction, and to perceive direct eye contact as arousing but pleasurable, rather than aversive (as is generally the case in animals) might be important evolutionary developments (Emery, 2000). A greater social focus may have allowed the extension of the action-understanding system from purely transitive actions to include intransitive ones, allowing the convergence of imitation and communication described as mimesis by Donald.

One prediction made by Heyes is that counter-imitative neurons may exist for actions that are often paired with non-matching actions. An example may be neurons that code for both the perception of another animal attacking and the motor response of withdrawing. Presumably this hypothesis could be tested in macaques. Meltzoff suggests that rearing monkeys wearing collars to prevent them from viewing their own hands may provide a route to establishing whether mirror neurons develop through experience or are innate. It is clear that there is still much to clarify regarding the developmental route to imitation and the role played by mirror neurons.

With these uncertainties in mind, it is of interest to read *Imitation and Culture*. Huesmann discusses the effects of media violence, suggesting that imitation is one of the mechanisms that underlie the progression to real life aggression. Huesmann cites laboratory-based studies that show that when children view violent behaviour on film it increases the probability that they will engage in aggressive play immediately afterwards. In terms of real life aggression, a number of longitudinal studies have demonstrated that exposure to media violence in childhood correlates modestly with later aggression and criminal behaviour. Though Huesmann concludes that these studies provide adequate proof of a causal relationship between viewing violence and behaving violently, alternative explanations should be considered. Correlational research can never unambiguously provide evidence of causation, and two variables can be correlated for many reasons. It is possible that other variables act on both children's television viewing and later tendency to violent behaviour. For example, social factors may affect both the level of supervision of television viewing (lack of which may increase the likelihood of viewing 'inappropriate' material) and later behaviour; or genetic factors (acting on parents and children in a family) may influence both variables. Twin studies have challenged the consensus on other environmental risk factors, such as smoking during pregnancy and child antisocial behaviour (Maughan, *et al.*, 2004), and may help disambiguate the data in this area.

A possible basis for the influence of media violence could be the various forms of nonconscious imitation described by Dijksterhuis. These include mirroring of expressions, postures and actions known as the 'chameleon effect' (Chartrand and Bargh, 1999) and priming of social stereotypes. The latter may be of more interest in relation to long-term effects. In one experiment, participants who had been surreptitiously primed with a stereotype of the elderly afterwards walked more slowly when compared to controls (Bargh, Chen and Burrows, 1996), and it is possible that violence could be primed in the same way. However, as Litman cautions, these effects are 'quite subtle and easily inhibited' (vol. 2, p. 366). For example, the conscious need to hurry is likely to override the tendency to walk slightly slower. Importantly, priming seems to modulate ongoing behaviour rather than eliciting genuinely new actions.

Claxton makes the point that we learn selectively from certain people and that we need to identify with someone before the barriers to imitative tendencies are taken down, and Eldridge reminds us that we bring our own values and interpretations to media portrayals of violence. In the context of these

comments it is perhaps of more interest to ask why some children identify with the perpetrators of violence rather than the victims of it, and why they selectively internalise some social values rather than others. After all, if the story were as simple as automatic imitation of media violence leading to aggression then we would predict that the children who tend to imitate most would be the ones most likely to engage in violent behaviour after viewing violence. This stands in direct contrast to the case presented by Prinz, who argues that imitation plays a central role in the early development of moral emotions through children 'catching' sadness from the victims of aggression. Presumably, when children view media violence different outcomes and interpretations are possible, depending on the context and scaffolding provided by caregivers. Exploration of these other factors may better illuminate our understanding of why some children become violent. Jones cautions in Volume 1 that we should not try 'to make the mirror neuron fit existing holes in our theories' of imitation (vol. 1, p. 210). Equally, we should not try to use imitation to 'fit the holes' in social and psychological theories of violent behaviour.

The final four chapters of the second volume deal with meme theory and whether it has the capacity to explain the development of human culture. Blackmore, in three commentaries on other chapters, defends the idea that cultural change occurs through a process analogous to biological evolution, where memes act as replicators, variation arises through copying error and recombination of memes, and selective imitation preserves some memes over others. Mimeticists observe that the ideas that are common now are those that were best at being replicated. However, this doesn't necessarily have any real explanatory power, especially if 'selective pressures' include human goals. Greenberg criticises memetics on the basis that much of human culture is better explained as the result of 'planful, foresighted decisions in pursuit of people's conscious goals' (vol. 2, p. 341), and that the fact that historical change builds on previous ideas does not mean that the mechanism must be Darwinian. Chater recognises the problematic nature of applying the Darwinian metaphor of a 'blind watchmaker' to cultural change, as it essentially involves denying that there are such things as 'sighted watchmakers' in human society (vol. 2, p. 360). When Blackmore argues that human goals should be 'given the same status that the goals of plants and animals are given in biological evolution' (vol. 2, p. 410) she perhaps gets to the hub of memetics as a theory that is quick to deny human exceptionalism. This outlook chimes with contemporary anti-humanism, which 'assigns an undistinguished if not low status to the human species' (Furedi, 2005, pp. 93–96). The reaction against the Enlightenment version of Man, as rational and as unique in the natural world, has led to a more humble version of humanity being posited. Any theory that paints humans as passive objects of history, rather than as active subjects capable of striving for change, captures the popular imagination and taps into ideas about needing to 'know our place' in the natural order.

Greenberg, Chater and Gil-White correctly point out that if meme theory is to justify itself it must be supported by empirical data. Currently, it seems that the theory gains its power through resonance with popular ideas about the inability of humans to shape the forces of history, rather than having any real explanatory power. To some extent, the readiness to view subconscious imitative tendencies and priming effects as having more power over our behaviour than conscious decisions also reflects this diminished view of humanity.

Perspectives in Imitation covers a wide range of imitation research from a number of different disciplines in an accessible, yet thought-provoking way. It captures the evident excitement created by the discovery of mirror neurons, and the realisation that imitation seems to be a pervasive form of behaviour in human society. However, it is important not to let the momentum generated by these discoveries carry us beyond what has actually been demonstrated. Mirror neurons do not, in

themselves, explain our ability to imitate and nonconscious tendencies to imitate others in some situations are unlikely to provide a complete explanation for why some people apparently copy media violence. Likewise, the fact that imitation can allow cultural transmission of ideas does not necessarily mean that memetics is the most convincing explanation. As long as we do not attempt to force imitation to be the answer to every question about human development and society, this fascinating research has the potential to continue to contribute to the debate about what it is that really makes us human.

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