



COMMENTARY

Rattling the developmental psychologist's cage?

Diane Poulin-Dubois

Department of Psychology, Concordia University, Canada

This is a commentary on Heyes (2015).

In her provocative paper, Heyes argues that recent research on the development of social learning that suggests that even infants show selectivity in when and who to copy, has failed to demonstrate that it is a distinctive feature of human social learning (Harris, 2012; Mills, 2013; Poulin-Dubois & Brosseau-Liard, in press; Wood, Kendall & Flynn, 2013). In order to do so, Heyes advises developmental scientists to develop their research program in three directions: distinguish between functions and psychological mechanisms; fully integrate the findings with the rest of cognitive science; recognize that multiple sources can account for specialized mechanisms.

From when and who to how and why?

In the last decade, there has been an explosion of studies identifying strategies under which a variety of species of animals copy others (Gariépy Watson, Du, Xie, Erb *et al.*, 2014; Hoppit & Laland, 2013). The bulk of this research has been about context-dependent strategies (e.g. state based, frequency-dependent, and model based). There are functional parallels in the social learning of human and non-human animals (Rendell, Fogarty, Hoppitt, Morgan, Webster *et al.*, 2011). Regarding model-based strategies, when young children select a competent, reliable informant over an incompetent one, the interpretation of such selectivity could be rich (belief in trustworthiness) or lean (acting *as if* believing in trustworthiness). I agree with Heyes that there is a conflation of mechanistic vs. functional interpretations that is rampant in research on human social learning. Obviously, this is a challenge that is less acute in model-based learning in other species, as when explaining why a rat chose to press a left or right lever based on a model's choice (Heyes, Dawson & Nokes, 1992). The richness of interpretation is a debate that is recurrent in research on infant cognition and Heyes has

raised a similar argument about the interpretation of findings on early theory of mind and rational imitation (Heyes, 2014, in press). First, it is important to point out that selective trust has a protracted development as a number of studies indicate that older children show a deeper understanding of who and when to imitate. For example, 3-year-olds are more likely to imitate inefficient actions, to prefer familiar inaccurate informants over unfamiliar accurate ones and show a weaker tendency to learn from a previously accurate informant than older children (Corriveau & Harris, 2009; Di Yanni & Kelemen, 2008; Koenig, Clément & Harris, 2004). The fact that this developmental period coincides with significant changes in children's mind reading skills has not gone unnoticed. In order to determine whether these abilities are related, researchers have assessed both using within-subject designs and found that theory-of-mind understanding and selective trust are related (Di Yanni & Kelemen, 2008; Di Yanni, Nini, Rheel & Livelli, 2012; Fusaro & Harris, 2008). More recently, we reported that theory-of-mind abilities predict children's preference to learn from more accurate informants but not from physically stronger informants (Brosseau-Liard, Penney & Poulin-Dubois, 2015). Still, cognitive factors accounted for a small portion of the variance in selective trust performance, so variables such as personality and social factors (e.g. parental orientation toward authoritarianism) must matter as well (Tagar, Federico, Lyons, Ludeke & Koenig, 2014). In infancy, putative mechanisms to explain selective trust have started to be investigated in my laboratory, such as statistical learning and implicit theory-of-mind abilities.

Special mechanisms?

Heyes argues that the selectivity of social learning in children can help us to understand the human capacity

Address for correspondence: Diane Poulin-Dubois, Department of Psychology, Concordia University, 7141 Sherbrooke Street West, Montréal, Québec, H4B 1R6, Canada; e-mail: diane.pouлиндubois@concordia.ca

for cultural evolution to the extent that it depends on special psychological mechanisms. The only way to find out for sure is to compare the selectivity of asocial learning in humans with the selectivity of social and nonsocial learning in other animals. Concerning the first point, throughout their daily lives, children learn from their own observations and interactions with the world and also from the testimony of other people. It has been argued that it is unlikely that such everyday learning is governed by two separate processes – one for causal learning and the other for social learning. In their recent proposal, Sobel and Kushnir (2013) begin by noting a common theme in empirical research in both traditions: Children's causal and social learning involve being discriminant (i.e. selective) about new evidence – whether it be evidence for causal relations or evidence for reliability of testimony. They suggest that this is not a coincidental similarity, but rather that it indicates the presence of a shared inferential mechanism – a rational one. There is much merit to this approach but more empirical evidence is needed to support its claims. In my view, more critical evidence would come from a comparison with social learning in other animals.

Heyes reviews recent research about some of the model characteristics that predict copying in children (age, group membership, prestige and reliability) and concludes that there is no basis to invoke social mechanisms specialized for cumulative cultural inheritance to account for the findings. The fact that infants prefer to imitate an adult model for novel actions (head-touch) and a peer for familiar actions is explained by effector matching in the novel action (moving the same part of the body) which would be facilitated by the salience of the adult face for infants (Zmyj, Daum, Prinz, Nielsen & Aschersleben, 2012). Given that only imitation of novel actions is relevant for cultural learning, there is a need for replication and extension of these findings, but increased attention to the adult face is unlikely to account for this result as infants do not imitate the head-touch when the hands of the adult model are occupied (Gergely, Bekkering & Király, 2002) or when pedagogical cues are missing (Wu & Kirkham, 2010). In sum, if infants have the goal to learn (a cognitive function of imitation), other model characteristics such as perceived competence guide their imitative behavior (Zmyj, Buttelmann, Carpenter & Daum, 2010). In fact, competence trumps age even in very young children (Jaswal & Neely, 2006). Another model characteristic that drives selective learning is group membership, with even infants more likely to learn from an adult who speaks their native language (Buttelmann, Zmyj, Daum & Carpenter, 2013). Again, such preference is unlikely due to increased attention to the face because infants tend to stare at the

mouth of someone who speaks in a foreign language (Lewkowicz & Hansen-Tift, 2012). Nevertheless, a recent attempt at replication reported that infants can modulate their learning based on social category information; however, these effects are not pervasive across learning contexts and they may change with development (Howard, Carazza & Woodward, 2014).

Unlike other species, humans follow the example of prestigious, high-status individuals much more readily than that of others. Heyes argues that the available evidence with children could be explained by domain-general psychological processes, such as negative priming or higher-order conditioning. However, the fact that more advanced understanding of mental states predicted greater trust in the more prestigious informant challenges this low-level interpretation. Clearly, more research is needed on this type of strategy, particularly with a between-subjects design.

The last model-based strategy that is discussed by Heyes is accuracy or reliability of the model, the model characteristic that launched research on the development of epistemic trust (Harris, 2007). There are now a large number of studies showing that children are less likely to learn new information from inaccurate speakers or object users. There is also growing evidence that incompetent emoters, object users, and speakers are not only detected early in infancy but that infants as young as 8 months are less likely to learn or be influenced in their choices by unreliable individuals (see Poulin-Dubois & Brosseau-Liard, in press, for a review). In some cases, this bias could be explained by 'dumb' learned predictiveness, as in pigeons (Tummeltshammer, Wu, Sobel & Kirkham, 2014), but in other cases, such as better learning of new words or more reliable gaze following only for non-visible objects (Brooker & Poulin-Dubois, 2013; Chow, Poulin-Dubois & Lewis, 2008), this is unlikely to be an adequate interpretation. Furthermore, increased attention to the body of the reliable informant during the head-touch imitation task cannot explain similar effects in other imitation tasks (Brooker & Poulin-Dubois, 2013).

Now what?

I echo Heyes' plea for more research on selective social learning in infants and young children to identify the mechanisms (domain-general vs. domain-specific) accounting for similarities and differences across species. The ongoing research in my laboratory and others pitting domain-general skills such as associative and statistical learning against domain-specific skills such as theory-of-mind as predictors of

selective social learning across development is a promising step in that direction.

References

- Brooker, I., & Poulin-Dubois, D. (2013). Is a bird an apple? The effect of speaker labeling accuracy on infants' word learning, imitation, and helping behaviors. *Infancy*, **18**, E46–E68. doi: 10.1111/infa.12027
- Brosseau-Liard, P., Penney, D., & Poulin-Dubois, D. (2015). Theory of mind selectively predicts preschoolers' knowledge-based selective word learning. *British Journal of Developmental Psychology*, **33**, 464–475. doi: 10.1111/bjdp.12107
- Buttelmann, D., Zmyj, N., Daum, M., & Carpenter, M. (2013). Selective imitation of in-group over out-group members in 14-month-old infants. *Child Development*, **84**, 422–428. doi:10.1111/j.1467-8624.2012.01860.x
- Chow, V., Poulin-Dubois, D., & Lewis, J. (2008). To see or not to see: infants prefer to follow the gaze of a reliable looker. *Developmental Science*, **11**, 761–770. doi:10.1111/j.1467-7687.2008.00726.x
- Corriveau, K., & Harris, P. (2009). Choosing your informants: weighing familiarity and recent accuracy. *Developmental Science*, **12**, 426–437. doi:10.1111/j.14677687.2008.00792.x
- Di Yanni, C., & Kelemen, D. (2008). Using a bad tool with good intention: young children's imitation of adults' questionable choices. *Journal of Experimental Child Psychology*, **101**, 241–261. doi:10.1016/j.jecp.2008.05.002
- Di Yanni, C., Nini, D., Rheel, W., & Livelli, A. (2012). 'I won't trust you if I think you're trying to deceive me': relations between selective trust, theory of mind, and imitation in early childhood. *Journal of Cognition and Development*, **13**, 354–371. doi:10.1080/15248372.2011.590462
- Fusaro, M., & Harris, P. (2008). Children assess informant reliability using bystanders' non-verbal cues. *Developmental Science*, **11**, 771–777. doi:10.1111/j.14677687.2008.00728
- Gariepy, J.F., Watson, K.K., Du, E., Xie, D.L., Erb, J., et al. (2014). Social learning in humans and other animals. *Frontiers in Neuroscience*, **8**, 58. doi:10.3389/fnins.2014.00058
- Gergely, G., Bekkering, H., & Király, I. (2002). Rational imitation in preverbal infants. *Nature*, **415** (6873), 755. doi:10.1038/415755a
- Harris, P.L. (2007). Trust. *Developmental Science*, **10**, 135–138. doi:10.1111/j.14677687.2007.00575.x
- Harris, P.L. (2012). *Trusting what you're told: How children learn from others*. Cambridge, MA: Belknap Press/Harvard University Press.
- Heyes, C. (2014). False belief in infancy: a fresh look. *Developmental Science*, **17**, 647–659. doi:10.1111/desc.12148
- Heyes, C. (2015). When does social learning become cultural learning? *Developmental Science*, doi:10.1111/desc.12350
- Heyes, C. (in press). Born pupils? Natural pedagogy and cultural pedagogy. *Perspectives on Psychological Science*.
- Heyes, C.M., Dawson, G.R., & Nokes, T. (1992). Imitation in rats: initial responding and transfer evidence. *Quarterly Journal of Experimental Psychology*, **45B**, 81–92. doi:10.1080/14640749208401018
- Hoppitt, W., & Laland, K.N. (2013). *Social learning: An introduction to mechanisms, methods, and models*. Princeton, NJ: Princeton University Press.
- Howard, L.H., Carazza, C., & Woodward, A. (2014). Neighborhood linguistic diversity predicts infants' social learning. *Cognition*, **133**, 474–479. doi:10.1016/j.cognition.2014.08.002
- Jaswal, V.K., & Neely, L.A. (2006). Adults don't always know best: preschoolers use past reliability over age when learning new words. *Psychological Science*, **17**, 757–758. doi:10.1111/j.1467-9280.2006.01778.x
- Koenig, M., Clément, F., & Harris, P. (2004). Trust in testimony: children's use of true and false statements. *Psychological Science*, **15**, 694–699. doi:10.1111/j.0956-7976.2004.00742.x
- Lewkowicz, D.J., & Hansen-Tift, A.M. (2012). Infants deploy selective attention to the mouth of a talking face when learning speech. *Proceedings of the National Academy of Sciences, USA*, **109**, 1431–1436. doi:10.1073/pnas.1114783109
- Mills, C.M. (2013). Knowing when to doubt: developing a critical stance when learning from others. *Developmental Psychology*, **49**, 404–418. doi:10.1037/a0029500
- Poulin-Dubois, D., & Brosseau-Liard, P. (in press). The developmental origins of selective social learning. *Current Directions in Psychological Science*.
- Rendell, L., Fogarty, L., Hoppitt, W.J., Morgan, T.J., Webster, M.M., et al. (2011). Cognitive culture: theoretical and empirical insights into social learning strategies. *Trends in Cognitive Sciences*, **15**, 68–76. doi:10.1016/j.tics.2010.12.002
- Sobel, D.M., & Kushnir, T. (2013). Knowledge matters: how children evaluate the reliability of testimony as a process of rational inference. *Psychological Review*, **120**, 779–797. doi:10.1037/a0034191
- Tagar, M.R., Federico, C.M., Lyons, K.E., Ludeke, S., & Koenig, M.A. (2014). Heralding the authoritarian? Orientation toward authority in early childhood. *Psychological Science*, **25**, 883–892. doi:10.1177/0956797613516470
- Tummeltshammer, K.S., Wu, R., Sobel, D.M., & Kirkham, N.Z. (2014). Infants track the reliability of potential informants. *Psychological Science*, **25**, 1730–1738. doi: 10.1177/0956797614540178
- Wood, L.A., Kendal, R.L., & Flynn, E.G. (2013). Whom do children copy? Model-based biases in social learning. *Developmental Review*, **33**, 341–356. doi:10.1016/j.dr.2013.08.002
- Wu, R., & Kirkham, N.Z. (2010). No two cues are alike: depth of learning during infancy is dependent on what orients attention. *Journal of Experimental Child Psychology*, **107**, 118–136. doi:10.1016/j.jecp.2010.04.014
- Zmyj, N., Buttelmann, D., Carpenter, M., & Daum, M.M. (2010). The reliability of a model influences 14-month-olds' imitation. *Journal of Experimental Child Psychology*, **106**, 208–220. doi:10.1016/j.jecp.2010.03.002
- Zmyj, N., Daum, M.M., Prinz, W., Nielsen, M., & Aschersleben, G. (2012). Fourteen-month-olds' imitation of differently aged models. *Infant and Child Development*, **21**, 250–266. doi:10.1002/icd.750