Available online at www.sciencedirect.com

ScienceDirect

Physics of Life Reviews 30 (2019) 83–85

PHYSICS of LIFE reviews

www.elsevier.com/locate/plrev

Comment

Form and function in the imitative learning of language Comment on "Replication and emergence in cultural transmission" by Monica Tamariz

Richard Moore *

Received 21 July 2019; accepted 24 July 2019
Available online 29 July 2019
Communicated by E. Di Mauro

Tamariz [1] defends a new 'replication and emergence' model of the cognitive mechanisms that support social (e.g. imitative) learning in human development. Central to this account are two proposals: (1) "actions – motor, observable aspects of behaviour – *replicate*; in other words, they undergo direct social, faithful and content-indifferent copying by naive learners" and (2) "mental culture *emerges* or develops within each individual when the inherited actions are deployed for their normal function during usage in context" (section 1).

On Tamariz's development of this view, the first of these proposals entails that imitative learners copy observed behaviours, in the first instance, without consideration of or insight into why the copied agent would perform that action. The agent is merely concerned to recreate precisely the behaviour that she observed. As Tamariz later expresses this point: "The reasons for copying actions must ... be found not in functionality, but elsewhere" (section 3.3). That elsewhere, Tamariz suggests, lies potentially in affiliative copying [2].

The second proposal suggests that it is only later, after replicative learning has taken place, that imitating agents come to appreciate the functional reasons for performing the actions they have copied. This insight comes through subsequent associative learning – for example, when agents reproduce the behaviours they have learned to replicate, observe their consequences, and thereby learn something of the action functions. To illustrate, consider an example borrowed from Wittgenstein [3], [4]. An agent observes another utter the word "Slab!" in order to request a slab. Copying the observed agent's behaviour, in the first instance she is concerned only with the correct articulation of the word "Slab!" and pays no attention to its function. (This is what it means to say that her replication was indifferent to the content of the copied behaviour; the agent was concerned only with replicating its form.) Later, by uttering "Slab!" for herself, and observing the effects of her speaking, the imitating agent can learn something of its function – that is, its meaning; its usefulness for requesting slabs. This is what it means to say that mental culture emerges: knowledge of the function of the imitated behaviour emerges only subsequent to the replication of its form.

This picture of imitative learning lends itself to a story on which agents who understand nothing of the goals of others but who are concerned to affiliate with them can nonetheless learn from them. It sketches a way in which understanding of goal directed behaviour could be emergent; itself an indirect product of social learning. To this extent it is consistent with other accounts of cognitive development that takes goal understanding to arise through associative learning – for example, Celia Heyes's associationist account of the origins of the Mirror Neurons System [5]. It

DOI of original article: https://doi.org/10.1016/j.plrev.2019.04.004.
* Correspondence address: Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany.
E-mail address: r.t.moore@gmail.com.

https://doi.org/10.1016/j.plrev.2019.07.009

positions itself in opposition to accounts of our understanding of goal-directed behaviour that see it as unlearned – for example, the result of an inherited Mirror Neurons System that gives us direct perceptual knowledge of the goals underlying others' actions [6].

Tamariz's article makes a series of important points. First, as others have noted, precise replication of actions is particularly important for the accurate transmission of cultural traits [7], [8], [9]. This is particularly so where the functionality of copied behaviours is dependent on faithful copying – as with skills that cannot be reverse engineered [10], and the reproduction of arbitrary words and sentences [11]. It is right to emphasise that human copying is particularly attentive to the replication of forms. Such copying may also lend itself to the development of a number of important further skills [12]. It is also important to show how an understanding of object functions could emerge on the back of replicating object forms. In the course of developing her view, Tamariz also elaborates a number of key distinctions – not least between form and function, and the transmission of behaviours and knowledge of functions.

Problematically, at least sometimes Tamariz suggests a fixed developmental trajectory when describing the mechanisms that support social learning: copying "must not be motivated by achieving the action's functional or conventional goal" (3.3, p. 9); "instrumental skills are initially copied in a content-indifferent way and only later . . . is their function understood" (4.2, p. 14); "mental culture is emergent" (1.4, p. 5); and "expertise and understanding can only emerge through usage" (2.2.2, p. 7). My question here is why we should think that real world learning corresponds neatly to the developmental trajectory that Tamariz sketches. Even if form copying *can* precede function copying, why should it always? And even if functional knowledge *can* emerge on the back of form replication, why think this is how learning must unfold?

These questions are worth our attention because even if one accepts that understanding of goals is *in general* emergent in ontogeny, this would not entail that children (and animals) grasp the contents of particular goals only anterior to mastering the behaviours with which such goals are pursued. Indeed much of children's learning takes place against a background understanding of goal-directed behaviour. It is presumably only because of this understanding that both children and dogs are capable of one-shot learning of the meanings of words (see [12] for discussion). On both empirical and theoretical grounds there is no problem with claiming that learners can learn simultaneously the meaning of a word (i.e. its function) and its pronunciation (i.e. form). On other occasions learners might grasp the function of a word before they grasp its form – for example, when a learner infers a speaker's communicative intention but did not hear what exactly she said.

Any explanation of the mechanisms of social learning must explain how this is possible. On an imitative learning story that stipulates no invariant learning trajectory, this is unproblematic. On some occasions a learner could utter the word "Slab!" while paying attention to only its form and ignoring its function. On other occasions, perhaps against an already developing understanding of goal directed activity, an agent might attend to both form and function. In a third case (perhaps where a word was already familiar) a learner might prioritise inferring a behaviour's function. All of these trajectories are possible. Moreover, none would undermine Tamariz's claim that while behaviours can be copied, understanding of functions is inferred or reconstructed. (This latter claim does not concern the trajectory of our social learning, so much as the mechanisms that support it.)

This qualification of Tamariz's view is important, because while it is right to prioritise a view of social learning that can explain both the fidelity of human copying and the possibility of gaining understanding through use, to insist that our social learning mechanisms entail a fixed learning trajectory would too easily generate a long list of problematic counter-examples. What a good account must do, though, is explain how our social learning can deliver both emergent understanding through practice and one-shot learning. An imitative learning mechanism that emphasises both attention to form and function can do this. Moreover, it can explain variation in the learning trajectory on the basis of variables like (1) the prior knowledge states of a copying individual, and (2) variations in the way that an individual attends to the behaviour they are copying. Such variation need not entail an assumption that different learning mechanisms are in play. So long as agents can selectively attend to both form and function, while copying behaviours and inferring goals, the same imitative learning mechanisms can sustain language learning throughout ontogeny.

Acknowledgements

Thanks to Harriet Over for helpful feedback on this comment.

References

[1] Tamariz M. Replication and emergence in cultural transmission. Phys Life Rev 2019;30:47–71. https://doi.org/10.1016/j.plrev.2019.04.004 [in this issue].
[2] Over H, Carpenter M. Putting the social into social learning: explaining both selectivity and fidelity in children's copying behavior. J Comp Psychol 2012;126(2):182.
[3] Wittgenstein L. Philosophical investigations. 3rd edn. Blackwell: Trans. G. Anscombe; 2018.
[4] Moore R. Imitation and conventional communication. Biol Philos 2013;28(3):481–500.
[5] Heyes C. Cognitive gadgets: the cultural evolution of thinking. Harvard UP; 2018.
[6] Rizzolatti G, Sinigaglia C. Mirrors in the brain: how our minds share actions and emotions. Oxford UP; 2008.
[7] Boesch C, Tomasello M. Chimpanzee and human cultures. Curr Anthropol 1998;39(5):591–614.
[8] Tomasello M. Origins of human communication. The MIT Press; 2008.
[9] Fridland E, Moore R. Imitation reconsidered. Philosl Psychol 2015;28(6):856–80.
[10] Tennie C, Call J, Tomasello M. Ratcheting up the ratchet: on the evolution of cumulative culture. Philos Trans R Soc B 2009;364(1528):2405–15.
[11] Fridland E. Do as I say and as I do: imitation, pedagogy, and cumulative culture. Mind Lang 2018;33(4):355–77.
[12] Moore R. Gricean communication, language development, and animal minds. Philos Compass 2018;13(12):e12550.