

social behaviours, and to further consider how such processes are influenced by universal developmental phenomena such as behavioural stereotypes.

## Philosopher's disease and its antidote: Perspectives from prenatal behavior and contagious yawning and laughing

doi:10.1017/S0140525X16001254, e399

Robert R. Provine

Department of Psychology, University of Maryland, Baltimore County,  
Baltimore, MD 21250.

[provine@umbc.edu](mailto:provine@umbc.edu)

**Abstract:** Accounts of behavior, including imitation, often suffer from *philosopher's disease*: the unnecessary, inappropriate, theoretically driven explanation of behavior in terms of cognition, rationality, and consciousness. Embryos are perversely unphilosophical and unpsychological, starting to move before they receive sensory input. Postnatal contagious yawning and laughing indicate that pseudo-imitative behavior can occur without conscious intent or other higher-order cognitive process.

When we seek to understand behavior—our own and that of others—we suffer from *philosopher's disease*: the unnecessary, inappropriate, theoretically driven casting of behavior in terms of higher-order cognitive processes. In these accounts, we often commit the *error of intentionality*, the over-estimate of our voluntary, conscious control of behavior. The antidote for philosopher's disease and its associated theoretical biases is research based on the natural priorities of organisms that is derived from objective descriptions of behavior. I suggest that we are not very good philosophers and can benefit from the examination of nontraditional sources for insight and guidance, especially prenatal behavior and postnatal contagious behaviors such as yawning and laughing (Provine 2012).

The best place to start the investigation of behavior is at the beginning—prenatal behavior. Early embryos are profoundly unphilosophical and unpsychological beings that start to move before they receive sensory input. They spond before they respond. Such motor precocity is an awkward fact for developmental psychologists who seek only environmentally driven causes of behavior (sensation/perception, learning, motivation, etc.) and neglect spontaneous movement (Provine 2012). The agenda of postnatal psychology fares poorly when forced upon the prenatal domain. Even after sensory input becomes available, it has little impact on most ongoing behavior during the prenatal period (Provine 1972). If this is not challenge enough, the spinal cord, not the brain, is the origin of the electrical discharges that drive much embryonic behavior (Provine & Rogers 1977). Both the functions and causes of embryonic behavior are novel and unique to the prenatal niche. Embryonic movement is essential for the development of joints, muscles, and the regulation of neuron numbers, behavioral consequences neglected by most developmental psychologists (Provine 2012). How many developmental psychologists know that paralyzing embryos blocks the naturally occurring death of motor neurons?

Instinctive yawning (Provine 2005), and laughing (2000; 2016; 2017) provide informative examples of erroneous thinking about the causes of behavior. Yawning is considered a pseudolinguistic gesture of sleepiness or boredom, and laughing is a play vocalization emitted in certain social settings, but neither is under strong voluntary control. We can neither convincingly yawn nor laugh on command, and attempts to do so seem fake and have long latencies (Provine 2012). However, lack of conscious control does not curtail the composition of fictive narratives to explain their occurrence.

Contagion provides another challenge to the myth of conscious control that is especially relevant to the issue of infant imitation of the sort reported by Meltzoff and Moore (1977) (Provine 1989a; 2012). When we yawn in response to observed yawns (Provine 1986) or laugh in response to observed laughs (Provine 1992), is it a conscious effort to imitate another person? Both options are unlikely, given the low level of voluntary control of yawning and laughing (Provine 2012). I suggest, instead, that such contagion is the involuntary consequence of activation of a feature detector for yawns or laughs in the observer's brain. The detector for laughter is probably acoustic—the sound of laughter triggers laughter of the listener (Provine 1992; 2000). The trigger for yawning is more broadly tuned—almost any stimulus associated with yawning will trigger yawns, including looking at them (Provine 1986; 1989b), hearing them, thinking about them (Provine 1986), or even reading about them as you are now doing (Provine 1986). If you desire a broader menu of contagious and pseudo-imitative acts, examine coughing, vocal crying, emotional tearing, reddening of the eyes, nausea/vomiting, and itching/scratching (Provine 2012).

## Animal studies help clarify misunderstandings about neonatal imitation

doi:10.1017/S0140525X16001965, e400

Elizabeth A. Simpson,<sup>a</sup> Sarah E. Maylott,<sup>a</sup> Mikael Heimann,<sup>b</sup> Francys Subiaul,<sup>c</sup> Annika Paukner,<sup>d</sup> Stephen J. Suomi,<sup>d</sup> and Pier F. Ferrari<sup>e,f</sup>

<sup>a</sup>Department of Psychology, University of Miami, Coral Gables, FL 33146;

<sup>b</sup>Department of Behavioral Sciences and Learning, Linköping University, SE-581 83 Linköping, Sweden; <sup>c</sup>Department of Speech and Hearing Science, George Washington University, Washington, DC 20052; <sup>d</sup>Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Dickerson, MD 20842; <sup>e</sup>Dipartimento di Neuroscienze, Università di Parma, 43123 Parma, Italy; <sup>f</sup>Institut des Sciences Cognitives Marc Jeannerod, CNRS / Université Claude Bernard Lyon, 69675 Bron Cedex, Lyon, France.

[simpson@miami.edu](mailto:simpson@miami.edu) <http://www.psy.miami.edu/faculty/esimpson>

[smaylott@miami.edu](mailto:smaylott@miami.edu) <http://www.psy.miami.edu/sci/people.phtml>

[mikael.heimann@liu.se](mailto:mikael.heimann@liu.se)

<http://www.ibl.liu.se/medarbetare/heimann-mikael?l=en&sc=true>

[subiaul@gwu.edu](mailto:subiaul@gwu.edu) <http://www.subiaul.com>

[paukner@mail.nih.gov](mailto:paukner@mail.nih.gov) [https://www.nichd.nih.gov/about/staff/](https://www.nichd.nih.gov/about/staff/Pages/bio.aspx?nih_id=0012459403)

[Pages/bio.aspx?nih\\_id=0012459403](https://www.nichd.nih.gov/about/staff/Pages/bio.aspx?nih_id=0010152932)

[suomis@lce.nichd.nih.gov](mailto:suomis@lce.nichd.nih.gov) [https://www.nichd.nih.gov/about/staff/](https://www.nichd.nih.gov/about/staff/Pages/bio.aspx?nih_id=0010152932)

[Pages/bio.aspx?nih\\_id=0010152932](https://www.nichd.nih.gov/about/staff/Pages/bio.aspx?nih_id=0010152932)

[pierfrancesco.ferrari@isc.cnrs.fr](mailto:pierfrancesco.ferrari@isc.cnrs.fr)

[https://web-ast.dsi.cnrs.fr/l3c/owa/personnel.frame\\_infos?](https://web-ast.dsi.cnrs.fr/l3c/owa/personnel.frame_infos?)

[p\\_etat=pe&p\\_numero\\_sel=1347787&p\\_i=0&p\\_nb\\_res=0&p\\_numero=0](https://web-ast.dsi.cnrs.fr/l3c/owa/personnel.frame_infos?p_etat=pe&p_numero_sel=1347787&p_i=0&p_nb_res=0&p_numero=0)

**Abstract:** Empirical studies are incompatible with the proposal that neonatal imitation is arousal driven or declining with age. Nonhuman primate studies reveal a functioning brain mirror system from birth, developmental continuity in imitation and later sociability, and the malleability of neonatal imitation, shaped by the early environment. A narrow focus on arousal effects and reflexes may grossly underestimate neonatal capacities.

Keven & Akins (K&A) propose that spontaneous aerodigestive behaviours may be mistaken for neonatal imitation; however, well-designed neonatal imitation studies already account for reflexive and arousal-driven responses (for a review, see Simpson et al. 2014a). When measuring arousal, either physiologically or behaviourally, and examining its relationship to imitative responding, evidence shows that for humans (e.g., Nagy et al. 2013) and nonhuman primates (NHP; e.g., Paukner et al. 2017; Simpson et al. 2014b), changes in arousal alone *cannot* account for neonatal imitation. In addition, K&A acknowledge that they “have not explained, so far, the differential responses of neonates

to specific gestures" (sect. 7.3.1, para. 2). We agree and further argue that differential imitation in neonates is incompatible with aerodigestive or arousal-driven explanations.

An additional misconception is that neonatal imitation is automatic and involuntary. Instead, infants exert active control over imitative responses and "provoke" previously imitated gestures, even after a delay, in both humans (Meltzoff & Moore 1994) and NHP (Paukner et al. 2011). Moreover, neonates are sensitive both to the type of action and the identity of the individual who modelled the action, initiating interactions only among social partners with whom they previously interacted (Paukner et al. 2011; Simpson et al. 2013). This ability is remarkable because it indicates that newborns are actively socially engaged (Meltzoff & Moore 1994). Consequently, delayed imitation is inconsistent with the proposal that neonatal imitation is a subcortical automatic response.

The aerodigestive hypothesis claims that imitative responses peak in the first week of life and decline in the following weeks. The data actually show the opposite for facial gestures: Neonatal imitative responses for tongue protrusion steadily increase in frequency from the first week to the ninth week (e.g., Oostenbroek et al. 2016; Meltzoff et al. in press 2017). Only after 3 months does the frequency of facial gesture imitation decline and infants begin to imitate other actions, such as sounds, vocalizations, and finger movements (Kuhl & Meltzoff 1996; Maratos 1998). Thus, although imitation does undergo changes with development, infants continue to reliably produce matching behaviours (for a review, see Simpson et al. 2014a). These findings support the idea that neonatal responses are not stereotypes but rather intentional, voluntary behaviours.

We agree with K&A that animal studies widen our understanding of various phenomena, including neonatal imitation. Nonetheless, in this instance, K&A neglect to consider animal studies in their potential to inform our understanding of infant social cognitive development (Gerson et al. 2016). For example, K&A claim, "neonatal imitation experiments provide the *only* evidence that mirror neurons are present at birth" (sect. 2, para. 7). Although we agree that neonatal imitation is behavioural evidence of a functioning mirror neuron system, this assertion overlooks NHP studies documenting cortical brain activity through electroencephalography (EEG) and reporting neural evidence of a mirroring system functioning from birth in newborn monkeys (Ferrari et al. 2012).

Furthermore, evidence from animal research is consistent with the premise that individual differences in neonatal imitation may reflect individual differences in sociability (Heimann 1989; Heimann et al. 1989). Neonatal imitation is hypothesized to be a developmental precursor for, and potentially predict, later social cognitive capacities (Heimann 1991; 2001; 2002; Suddendorf et al. 2013). Although this hypothesis has yet to be fully tested in humans, it has been tested in NHP (see recent review in Simpson et al. 2016). Infant monkeys who fail to exhibit neonatal imitation, compared to imitators, are less socially attentive (Simpson et al. 2014b), look less at faces in general and the eyes in particular (Paukner et al. 2014), exhibit poorer social cognitive skills such as imitation recognition (Simpson et al. 2015) and gaze following (Simpson et al. 2016), exhibit poorer goal-directed motor skills (Ferrari et al. 2009b), play less with peers and exhibit more anxious behaviour at one year of age (Kaburu et al. 2016). Together, these studies provide a more detailed view of the link between neonatal imitation, early social predispositions, and social development.

As a result of its plasticity, neonatal imitation may also be a fruitful target for intervention, as well as an early marker of sociality. Although we know little about the malleability of neonatal imitation in humans (Jacobson 1979; Kennedy-Costantini et al. 2016), animal studies enable the manipulation of infants' environments and experiences. In monkeys, across both naturalistic and experimental settings, neonatal experiences impact infants' social

capacities (Dettmer et al. 2016), including neonatal imitation, which is strengthened by face-to-face interactions in early infancy (Simpson et al. 2014a; Vanderwert et al. 2015). Contrary to the aerodigestive hypothesis, the aforementioned animal research strongly supports the social nature of neonatal imitation.

In sum, evidence to date is inconsistent with the view that neonatal imitation simply reflects spontaneous aerodigestive behaviours. Although we appreciate an approach mindful of the broader context of development, there is nonetheless a wealth of data that directly bear upon K&A's arguments. A narrow focus on arousal effects and reflexes may grossly underestimate neonatal capacities. Recognizing such capacities and establishing neonatal measures of sociality may help identify neonates who fall outside the range of healthy social development and may increase opportunities to intervene and foster positive child outcomes.

## An unsettled debate: Key empirical and theoretical questions are still open

doi:10.1017/S0140525X16001977, e401

Stefano Vincini,<sup>a</sup> Yuna Jhang,<sup>b</sup> Eugene H. Buder,<sup>c,d</sup> and Shaun Gallagher<sup>d,e,f</sup>

<sup>a</sup>UNAM Postdoctoral Fellowships Program, Instituto de Investigaciones Filosóficas, Universidad Nacional Autónoma de México, Ciudad Universitaria, C.P. 04510, Mexico City, Mexico; <sup>b</sup>Department of Speech Language and Audiology, Chung Shan University, Taichung 40201, Taiwan; <sup>c</sup>School of Communication Sciences and Disorders, The University of Memphis, Memphis, TN 38152; <sup>d</sup>The Institute for Intelligent Systems, The University of Memphis, Memphis, TN 38152; <sup>e</sup>Department of Philosophy, The University of Memphis, Memphis, TN 38152; <sup>f</sup>Faculty of Law, Humanities and the Art, University of Wollongong, Wollongong, NSW 2522, Australia.

stefano.vincini@gmail.com

http://www.filosoficas.unam.mx/sitio/stefano-vincini

yjhang@csmu.edu.tw https://sites.google.com/site/yjhang13/

ehbuder@memphis.edu

https://umwa.memphis.edu/fcv/viewprofile.php?uuiid=ehbuder

s.gallagher@memphis.edu http://www.ummoss.org

**Abstract:** Debates about neonatal imitation remain more open than Keven & Akins (K&A) imply. K&A do not recognize the primacy of the question concerning differential imitation and the links between experimental designs and more or less plausible theoretical assumptions. Moreover, they do not acknowledge previous theorizing on spontaneous behavior, the explanatory power of entrainment, and subtle connections with social cognition.

We praise the Keven & Akins (K&A) target article for emphasizing that neonatal imitation findings must be read in the broader context of sensorimotor development, especially as portrayed by Thelen (1979; 1981b). By describing tongue protrusion as one of many rhythmic stereotypies whose rate can increase in relation to arousal, and by indicating a precise timeline for the onset, development, and dropout of spontaneous tongue protrusion, K&A strengthen the arousal explanation of the neonatal imitation findings (Jones 2009). Nonetheless, their support for the arousal theory presents some shortcomings. Brief examination of some empirical studies and theoretical alternatives suggests that the debates about neonatal imitation, and its relevance to social cognition, remain more open than K&A imply.

K&A's characterization of the operational definition of neonate imitation (as "producing the modeled gesture more often than an unrelated one," (sect. 2, para. 2) is imprecise. Most empirical studies of neonatal imitation operationalize imitation as greater frequency of a gesture in response to the same gesture than in response to other gestures. The operational definition entails reference to a plurality of gestures exhibiting the comparative increase just described. This point is of critical importance because Meltzoff and Moore (1977) were well aware that, if