

Neonatal imitation, or the capacity of newborns to flexibly copy others' actions ... is one of the most controversial purported phenomena in all of psychological science.¹

1 Introduction

This is an account of the vicissitudes of theories associated with the idea of newborn imitation. Since 1977, when two American psychologists, Andrew N. Meltzoff and M. Keith Moore, published the results of their first experiments on the topic, the claim that babies can imitate certain facial and other movements at birth has become a core assumption of most accounts of neonatal behavior (Meltzoff & Moore 1977). Although some scientists had doubts, their criticisms were lost amid the general enthusiasm that greeted findings suggesting that neonates could undertake the complex task of copying specific movements, such as protruding the tongue and facial-emotional expressions.

New studies, however, have reexamined the data and found them wanting. In particular, a comprehensive longitudinal study of newborn imitation by Oostenbroek and her colleagues, published in 2016, found no evidence for it, with the result that the validity of the original claims have yet again been contested (Oostenbroek et al. 2016). According to these researchers, past findings have largely been an artifact of poorly controlled experimental conditions. Their conclusions have rekindled the debate between believers and skeptics on the issue of newborn imitation, and the course of the controversy shows no clear path toward resolution.

What is the dispute about? In important ways, the debate is about more than just neonatal imitation. We are witnessing unprecedented levels of scrutiny of previously “iconic” experiments at a time when worries about replicability and validity are tainting the psychological and social sciences (Zwan et al. 2018; Morawski 2019). The clash over the integrity of previous findings on newborn imitation belongs to this development. The details of the debate over methodology, control procedures, the role of publication bias, and related issues are clearly important. But what interests me is less the question of the solidity of the evidence favoring claims about neonatal imitation than the theoretical ideas about infant development that have been built on those claims. As Oostenbroek et al. have remarked, if their experimental findings and arguments hold up, then “the many prominent theories built upon the assumption of neonatal imitation ... are not empirically supported and should be modified or abandoned altogether” (Oostenbroek et al. 2016, 1336).²

¹ Davis et al. 2020, quoted by permission.

² The publication of this paper precipitated a number of exchanges and responses. See Meltzoff et al. 2018; Oostenbroek et al. 2018; Meltzoff et al. 2019; Davis et al. 2020; Redshaw et al. 2020. For

Oostenbroek et al. do not identify what prominent theories would require revision or rejection should neonatal imitation be disproven, but their remark indicates the important stakes that attend the outcome. These are what I plan to discuss. It will be impossible to do full justice to all the relevant issues, but I believe it will be useful to assemble in one analysis the various ramifications of the debate. By doing so, my aim is to provide a starting point for a larger history of the vicissitudes of the idea of newborn imitation.

2 Piaget Before Meltzoff and Moore

Participants in contemporary research on newborn imitation generally consider the topic to have been shaped by the founding work of the Swiss psychologist Jean Piaget (1896–1980). In the 1970s, before the impact of Meltzoff and Moore’s decisive intervention, Piaget’s widely influential studies of development in childhood had already become the focus of considerable scrutiny among American psychologists. His theoretical analyses and conclusions were being reassessed, and his empirical claims reexamined by ostensibly more rigorous experimental techniques than the more naturalistic and “anecdotal” methods he had used when studying individual children (Kaplan 1971, xv–xvi; Costall & Leudar 2004).

In discussions of Piaget’s work in the early 1970s, when his reputation among American psychologists was at its height, commentators focused as much on Piaget’s contributions to epistemology as on his empirical findings. The topic of infant imitation, which Piaget had investigated so carefully and whose development he had made central to the infant’s ability to construct its understanding of the world, tended to be mentioned only in passing (Kessen 1996, 196–99). The reception of his work in the 1970s in the USA belonged to a moment when the dominance of behaviorism was being challenged by a cognitive revolution that once again placed the human mind at the center of the psychological sciences. The premise that the tenets of behaviorism and learning theory were sufficient to explain all cognitive development gave way to the idea that more attention needed to be paid to the relations between the child’s mental structures and its environment. Authors recognized that Piaget had placed that question at the center of his approach to psychology, an approach he had labeled “genetic epistemology” (Piaget 1953; 1954; 1962; 1972; Piaget & Inhelder 1969).

It was understood precisely in this connection that Piaget had attempted to steer a careful middle course between, as he conceived it, the extremes of

further contributions to the dispute see also Ray & Heyes 2011; Oostenbroek et al. 2013; Suddendorf et al. 2013; Simpson et al. 2014; Jones 2016; 2017; Kennedy-Constantini et al. 2017; Keven & Akins 2017; Meltzoff 2017; Vincini et al. 2017b.

idealism (or rationalism, or what he called “preformationism”) on the one hand and empiricism on the other. Idealism, associated with the work of Kant and also Gestalt psychology, was seen by him as rightly stressing the role of cognitive structures or laws in mental development, but as neglecting the importance of individual experience. In contrast, he saw empiricism as properly emphasizing the contingencies of individual life but as disregarding the framework of the subject’s cognitive “schemas” within which, he held, mentation and intelligence were constructed. Thus, Piaget’s program in psychology stressed the roles of adaptation, homeostasis, assimilation, and autoregulation as biological and behavioral processes that mediated the relationship between the organism’s schemas of action and its exchanges with the environment at different stages in the development of cognition and knowledge.

Piaget’s contributions to genetic epistemology raised an important question. Had he achieved the right balance in his neo-Kantian or “dynamic” account of the relations between his postulated basic sensorimotor action programs or later cognitive schemas and the products of experience? The question became weightier when, influenced in part by Noam Chomsky’s contemporaneous assertions concerning the importance of genetically determined, universal grammatical structures in the acquisition of language competence (e.g., Chomsky 1968), commentators in the 1970s began to give increased attention to the role of innate cognitive organization and capacities in the child’s mental development.

The question of the respective merits of innatism versus constructivism in the origin of human mentation, especially the origin of human linguistic capacity, stimulated a highly informative debate between Piaget and Chomsky at a conference in 1975 (Piattelli-Palmarini 1980). More generally, we can say that this was a moment in American psychology when the previous hostility to biological explanations in psychology, based on the rejection of Nazi racism, gave way to a more general universalist and evolutionary-biological approach to human behavior. Chomsky’s postwar development of a theory of a universal grammar, the 1960s and 1970s rise of an evolutionary “affect program” approach to the emotions associated with the work of Silvan Tomkins and Paul Ekman (more on this in a moment), and the enthusiastic reception of Meltzoff and Moore’s claims for the innate imitative capacities of the newborn all belong to this development.

An important issue in this connection was whether Piaget had given a valid account of how infants and children acquire knowledge of objects and the world, especially how they form concepts (Bellin 1971, 86). Piaget had offered a complex picture of infant development in this regard. Among his pivotal insights was the claim that in infancy the development of concepts or the

“categories of reason” develop over time in a series of universal but discontinuous stages. Each stage was marked by specific, progressively more elaborate, cognitive schemas as the child constructs its knowledge of the world, with this knowledge in turn based on the interaction between its biological maturation and its perceptions of the environment.

For example, according to Piaget, in the first, “sensorimotor stage” of development, infants lack the mental representations of the world necessary for understanding object permanence. He demonstrated this empirically by showing that, at first, babies cannot appreciate that an object still exists when it is hidden from view. He therefore suggested that they do not possess the concept of an object and hence a true conception of physical reality, space, substance, and causal relations (Bellin 1971, 100). Piaget suggested that it is not until the ninth or tenth month that the child actively searches for vanished objects by removing materials that obscure them or hinder the child from reaching for them. According to Piaget, the infant’s initial understanding of the physical world is thus qualitatively different from that of the adult. The task of his research was to identify those differences.

Piaget’s discussions of the origin of concepts led investigators in several directions. In one direction, his arguments led to philosophical inquiries regarding the long-standing question of the nature of perception itself. Here, the key issue was whether perception was best thought of as inherently conceptual or whether it could be conceived as processing “stimuli” in the absence of conceptual knowledge. The philosopher David Hamlyn, in a 1971 commentary on Piaget, weighed in on the conceptualist side in Wittgensteinian terms not unlike those subsequently expressed forcefully and influentially by the philosopher John McDowell (Hamlyn 1971; 1978; Russell 1979; McDowell 1996). But Meltzoff and Moore’s claims for the capacity of newborns to imitate suggested that they possessed a perceptual-cognitive capability which preceded the acquisition of language and concepts. As we shall see, that is why, in the wake of such claims, several philosophers already committed to the idea of nonconceptual content in perception came to buttress their arguments by appealing to the findings of neonatal imitation.

In a more empirical direction, researchers questioned whether Piaget was right to suggest – as had Freud before him – that infants are born into an undifferentiated world of “blooming, buzzing confusion,” as William James had described it (James 1890, 488), in which at first they perceive no distinction between themselves and their environment. As the British developmental psychologist George Butterworth wrote in a volume of essays on the topic of Piaget’s epistemology: “Piaget’s account of the developmental dependencies between perceiving, acting, and knowing is based on the premise that the initial

relation between infant and environment is one of profound dualism ... According to Piaget there is no information in the structure of stimulation itself that will allow response contingent feedback to be distinguished from independent sensory data” (Butterworth 1982, 137). For Piaget, it is a developmental achievement when the child succeeds in understanding the separation between itself and others, and hence in differentiating its subjective experiences from an independent, objective reality.

That this self–world boundary was acquired, however, was antithetical to the position taken by Meltzoff and Moore. They proposed that from the start the newborn possesses the cognitive capacity to discriminate perceptually the borders between itself and other persons and objects, and can thus distinguish self and nonself. Their findings raised the following question: Is the newborn as “incompetent” and “un-adapted” to the concrete world of people and objects as Piaget had proposed? Or is the infant pre-equipped to a far greater degree than Piaget had realized? (Russell 1982, 19).

Such questions inspired a flurry of experimental work on infant perception. Hamlyn suggested that the issues raised by Piaget’s discussions of perceptual development were inherently philosophical and conceptual, so empirical investigations alone could not resolve the epistemological issues at stake. However, his suggestions did not deter the numerous researchers who embarked on detailed experimental studies of infant development at this time. An influential figure in this regard was the psychologist James Gibson, who rejected the perceptual constructivism central to Piaget’s views and instead, in his book *The Senses Considered as Perceptual Systems* (1966) and subsequent publications, proposed that the organism directly perceives or picks up “information” in the ambient visual array. According to Gibson, perception is not governed by internal, computational representations in the mind-brain, as cognitive scientists tended to argue, but stems directly from the stimulus. Nor does learning occur through a constructivist-conceptualizing process, as Piaget had suggested. Rather, it occurs through the infant’s increasing ability to extract information immediately from the environment by differentiating among properties and recognizing distinctive features. Those properties inhere in the environment itself, providing what Gibson came to call “affordances” to the developing organism (Gibson 1966, 2; see also Gibson 1986).

Exactly what Gibson meant by “information” and the notion of “affordance” has implications for the theoretical issues raised by claims about neonatal imitation. The relevant questions include whether (a) he successfully challenged cognitivist theories positing “inner representations” or information-processing functions mediating between the organism and the world, or instead succumbed to those same cognitivist theories; and (b), as he argued against

Kant, there is no need for references to “conception and belief” in immediate human perception. For the moment, though, it suffices to note that Gibson’s views were attractive to those involved in challenging Piaget’s ideas. Thus, based on both Gibson’s views and Meltzoff and Moore’s claims for inborn imitative skills, Butterworth assigned to the neonate a “pre-reflexive” level of sensory and perceptual awareness that “precedes the acquisition of self-conscious concepts and beliefs” (Butterworth 1982, 139). The implication was that infants possess the ability to make certain discriminations and judgments at the very start of life, without the need for learning – or indeed for any concepts at all. Similarly, and influentially, in *Varieties of Reference*, also published in 1982, the philosopher Gareth Evans cited Gibson’s work when defending the claim that the content of perception is nonconceptual – more on this later (Evans 1982, 122–23).

Another important figure, especially in the field of infant development, was Gibson’s wife, Eleanor Gibson, who at Cornell University pioneered the study of perception and perceptual learning in a variety of animals, including human infants. She adopted the same views concerning direct perception as her husband, and her work soon became a magnet for a cohort of talented younger psychologists committed to contributing to the field of infant development. They included Elizabeth Spelke (probably her best-known student) and Tom Bower, whose experiments and ideas, as we shall see, would play a crucial role in Meltzoff and Moore’s attempts to explain newborn imitation (Gibson 1969, 13–14).³

3 The Primordial Unity of the Senses

A key topic in the study of perception has been whether, as most psychologists have assumed, the different sensory modalities are originally distinct, such that “intermodal” connections or “transfers” require later learning and integration. Or might the reverse be true? Are we instead born with a primordial unity of the senses, a unity that must differentiate during individual development for us to have distinct modalities?

An important moment in the long history of discussion of this topic was when the seventeenth-century Irish writer William Molyneux posed a famous question to the philosopher John Locke: Will a man born blind and taught by touch to discriminate between a cube and a sphere of metal be able by sight alone, if his eyesight were to be restored in adulthood, to tell the difference between the two

³ For Eleanor Gibson’s well known “visual cliff” experiments appearing to show depth perception in non-human animals and human infants alike see Gibson & Walk 1960; Sorce et al. 1985; Rodkey 2015; Burman 2017.

shapes? Molyneux's answer was No, because the man would not have had the necessary prior experience of associating touch with sight. In other words, Molyneux held that the unity or integration of the senses was a product of learning and experience. Piaget agreed that the sensory modalities are at first separate and only become integrated with experience and the development of the relevant schemas (Gibson 1969, 230; see also Piaget & Inhelder 1969, 15; Morgan 1977).

Since Molyneux's query, various reports had appeared of the perceptual experiences of congenitally blind individuals whose sight had been restored in adulthood, with mixed conclusions. The topic interested both William James and Eleanor Gibson. As she observed, in the 1930s and onwards several authors had adopted the opposite position from that of Molyneux by arguing instead for the "unity of the senses," or what the Belgian psychologist Albert Michotte, in his influential studies of perception, called "amodal perception." By amodal perception Michotte meant the perception of information that is common or redundant across multiple senses (the phenomenon of synesthesia is an instance of this). As Gibson recounted, Michotte and his students demonstrated that subjects reported perceiving visual details that did not correspond to actual sensations but were instead a product of the total perceptual situation (Gibson cited Michotte et al. 1964). An example of this is what happens when discontinuities in the perception of a scene, due to the retinal blind-spot, are nevertheless filled in and the discontinuities ignored. Gibson accepted the phenomenon of amodal perception, though not Michotte's explanation of the phenomenon. This is because she believed that, according to James Gibson's perceptual theory, all the necessary information was already present in the visual field. As she remarked:

I shall borrow Michotte's term amodal, though not his interpretation of amodal perception. I mean the term to suggest that there is information in stimulation which is not tied to specific sensations but is rather invariant over them. Many distinctive features of objects and events are of this kind (corners, motions, temporal patterns, and transitions). Information for them may be extracted from more than one kind of sensory experience. Perhaps all cross-modal similarity is really amodal in this sense. In that case might not cross-modal transfer be explained on the basis of amodal identities, higher order properties of stimulation which are not sensation specific? (Gibson 1969, 219)

Gibson answered this question in the affirmative when she concluded: "The integration of originally separate [sensory] systems is not the way of development; it seems more likely that the systems did not originate as independent single channels; and that independence is a learned achievement rather than an interdependence" (Gibson 1969, 381).

The idea of the original unity of the senses and their subsequent differentiation in development was taken up and elaborated by Tom Bower, under the rubric “*supramodal*” perception. On the basis of his findings in numerous experiments on perception in young infants, Bower became convinced that the traditional view that sensory integration requires time and learning was incorrect. Infants as young as two weeks, he suggested, exhibited “marked distress” as measured by their surprise response when they perceived an approaching object. In his view, the finding of distress in such immature infants contradicted the theory that the perception of the solidity of objects was learned or constructed by associating tactile impressions and vision; hence, he concluded that the perception of the solidity of objects occurred in newborns. Bower was perhaps hasty when he inferred, from the signs of alarm in such a young baby at an approaching solid object, that it perceived and was therefore afraid of the impingement of a solid mass on its body, but this is the inference he made. On the basis of these and related considerations, he therefore suggested that vision and touch are coordinated in a unity at birth (Bower 1971, 32–33; see also Bower et al. 1970b, 51–53).

In a 1974 book on infant development, Bower named the system governing this primitive unity of the senses the *supramodal system*, defined as a system capable of discerning the properties of objects that can be specified via any sensory modality (Bower 1974a, 121). And in a paper that same year, he made the case for the evolutionary origins of the supramodal system, citing several studies apparently demonstrating the existence of auditory-visual and tactile-visual coordination in neonates (Bower 1974b, 151). I note that the debate between nativists, who, like Gibson and Bower, believe that infants are born with a unified sensory system that only becomes differentiated in development, versus the empiricists, who judge that life begins with differentiated sensory systems that are only integrated over time, has yet to be resolved. But I think it is fair to say that the preponderance of the available evidence favors the empiricist position, not the nativist one.⁴

⁴ It is a sign of the reach of Meltzoff’s claims about neonatal imitation that at the very start of their influential book, *The Merging of the Senses* (1993), authors Barry Stein and M. Alex Meredith observed, with reference to claims for the existence of neonatal imitation and the nativist position, that “whether newborns are already capable of apprehending unique qualities in different senses or actually perceive all senses as the same remain open questions.” They reproduced Meltzoff’s striking images showing 2- to 3-week-old babies ostensibly matching an adult’s modeling of certain facial movements (see Figure 1), but observed that there was no current support for Bower’s and others’ view that the different sensory modalities have evolved from an undifferentiated and therefore “supramodal” primordial system (Stein & Meredith 1993, x, 11–15, 21; see also Calvert et al. 2004). In a more recent publication, Stein and his coauthors again mention the behavioral evidence of neonatal imitation as showing that newborns can detect certain cross-modal correspondences in very early life. However, they go on to state that research on the

Curiously, in a hitherto unremarked paper of 1976, a year before Meltzoff and Moore reported their findings about newborn imitation, Bower published photographs showing a six-day-old baby, in the arms of its mother, imitating the protrusion of the mother's tongue.⁵ Bower treated the imitation as a significant example of the functioning of certain sensorimotor skills at birth, observing that:

In the area of sensory-motor coordination ... one must include the fact that newborn infants show an extraordinary capacity for imitating the behavior of an adult. For example, they are quite able to imitate an adult sticking out his tongue, opening his mouth, or widening his eyes. Indeed, this ability is the most remarkable example known of the competence of the newborn's perceptual system.

He went on to remark:

Consider what is involved in imitating someone's sticking out his tongue. The infant must identify the thing he sees in the adult's mouth as being a tongue ... He must realize that the thing he cannot see but can feel in his own mouth is also a tongue ... He must then execute fairly complex muscular movements in order to imitate what he sees. (Bower 1976, 38)

In other words, the newborn seemed capable of performing opaque or “non-visible” imitations, so-called because they are movements the baby makes in order to match its own proprioceptive sensations when moving its tongue (movements that it can feel but not see because it has yet to see its face in a mirror), with the movements of the tongue of an adult (movements that it can see but not feel).⁶

This imitative skill seemed extraordinary to Bower since it apparently required highly specific mapping between the visual and the proprioceptive systems. At first, he believed it was incompatible with his theory that perception starts with more abstract, unified supramodal responses and proceeds over time toward more differentiated sensory reactions (he would later change his mind about this; Bower 1978, 93; 1989a, 90–99; 1989b, 31–32). But Meltzoff and Moore had no such qualms: they seized on Bower's idea of an innate

physiology of the development of cross-modal sensory integration in the superior colliculus of the newborn cat, the principal source of what is known on this topic, demonstrates that the capacity to integrate information across senses is not an inherent feature of the newborn's brain, but develops in “an experience-dependent manner during early postnatal life” (Stein et al. 2014, 521).

⁵ See also Jane Dunkeld's studies of infant imitation during the 1970s, undertaken at the direction of Bower (Dunkeld 1978). Dunkeld is credited with the photograph of neonatal imitation in Bower 1976 (see Bower 1977, 29).

⁶ For the term “non-visible” for newborn imitation, see Moore & Meltzoff 1978, 153.

“supramodal” perceptual capacity in order to explain their finding that newborns are able to imitate adult movements.

4 The Discovery of Newborn Imitation

Meltzoff and Moore’s announcement in 1977 that neonates are able to imitate certain facial and other movements in adults was hailed as revolutionary by many American psychologists (Meltzoff & Moore 1977).⁷ It was considered astonishing that newborns could produce such complex movements at the very start of life (Trevarthen et al. 1999, 128; see also Bower 1989b, 18). The phenomenon of imitation had been viewed as dependent on cognitive abilities that Piaget and others had deemed beyond the capacity of newborns. For Piaget, infants only develop the sensorimotor and cognitive skills necessary to achieve imitative matching at a later stage of development. Meltzoff and Moore deliberately threw down the gauntlet by confidently asserting that their experimental results disproved Piaget’s views: “The experiments we report show that the infant’s imitative competence has been underestimated. We find that 12- to 21-day-old infants can imitate both facial and manual gestures. This result has implications for our conception of innate human abilities and for theories of social and cognitive development” (Meltzoff & Moore 1977, 75).

Meltzoff and Moore’s experiments have been described so often that only the barest account of them is necessary here. In their first published experiment they tested the ability of six alert 12- to 21-day-old infants to copy four movements performed by an experimenter standing in front of them: tongue protrusion, mouth opening, lip protrusion, and a sequential finger movement (opening and closing the hand by serially moving the fingers). The experiment was undertaken specifically to assess Piaget’s claims for the late development of imitation in childhood. Each gesture was demonstrated four times in a 15-second stimulus presentation period, followed by a 20-second response period when the experimenter assumed a passive face. The infants’ responses were videotaped and scored in a random order by undergraduate volunteers who were asked to determine which facial gesture they thought the infant was most likely imitating in each recorded infant response. In the case of the hand movements, the coders were asked to assess which of four hand movements, including the sequential finger movements, they thought the infants were responding to.

⁷ The authors quickly published several more studies in which they announced their challenge to Piaget. As far as I am aware, the first published reference to Meltzoff and Moore’s findings is in Parton 1976, based on Moore & Meltzoff 1975. Meltzoff and Moore’s 1977 observations of early imitation was in fact preceded by some similar reports, including the following: Gardner & Gardner 1970; Maratos 1973.