

Hypotheses about Emotional Development in the Theory of Constructed Emotion: A Response to Developmental Perspectives on *How Emotions Are Made*

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In her recent book, *Why Trust Science?*, the historian of science Naomi Oreskes suggests that science is a valid guide for learning how the world works only when diverse and self-critical communities of scientists are able to come to consensus over the data. Consensus, in turn, rests on the process of critical interrogation (also called “transformational interrogation”; Longino, 1990, in Oreskes, 2019): scientists must have a shared interest in learning the truth (rather than being right) and must be open to skeptical questions, direct criticism, and disconfirming evidence. From this perspective, any commentary on one’s scientific work, even a critical commentary, is a gift that offers the opportunity for discovery (Barrett, 2020). I approached Sullivan and Minar’s commentary (this issue) on my book, *How Emotions Are Made: The Secret Life of the Brain*, in this spirit.

How Emotions Are Made describes a framework of hypotheses and data supporting the theory of constructed emotion (Barrett, 2017), which proposes that instances of emotion are not wired into your brain from birth but are constructed by your brain, as needed, in a context-specific

ic fashion. The theory proposes that you are continually faced with ambiguous, noisy information from your eyes, ears, nose, and other sensory organs, including those of the core systems within your body. Your brain, in constant conversation with your body and the surrounding world, is continuously imposing meaning on those sense data, selecting what is relevant and ignoring the rest, in the service of regulating your body. My students and collaborators propose that in every waking moment, your brain uses your past experience to construct hypotheses – as prediction signals – and compares those signals to the cacophony of arriving sense data. Your brain is not asking (figuratively speaking), “what are these sense data?” It is asking “what, in my past experience, is similar to this trajectory of sensory data?” Objects and events that are similar to one another in some way form a category, and a representation of a category is a concept, so the proposal is that your brain is constructing predictions, as ad hoc, situated concepts (or situated conceptualizations), to guide your actions and give your sensations meaning. The theory of constructed emotion is not well named, because the hypotheses we propose are not specific to the domain of emotion – the theory is, more broadly, a framework for asking questions about how your brain works, with inputs from your body and the world, to create your

mind and control your actions. When your brain's predictions involve re-instantiating past instances of emotion, your brain is, in effect, constructing emotion concepts to give sense data meaning, and in so doing making instances of emotion. There is ample empirical evidence from every domain of measurement that emotion categories are not structured as prototypes but as populations of highly variable instances that are functionally similar to one another in a specific context (for a discussion, see Hoemann, Wu, LoBue, Oakes, Xu, & Barrett, 2020). By implication, emotion concepts are abstract and the exemplars that make up any given category are tailored, on a moment-to-moment basis, to specific situations or contexts. Some basic questions of emotional development, then, are how do infants and young children learn emotion categories? How do their brains learn to construct and use emotion concepts? And what role do these concepts play in their ability to experience and perceive emotions?

The theory of constructed emotion offers hypotheses about emotional development, some of which are outlined in *How Emotions Are Made*, and which are elaborated and refined in subsequent papers (Hoemann, Xu, & Barrett, 2019; Hoemann, Devlin, & Barrett, 2020; Hoemann et al., 2020). Sullivan and Minar comment only on the book, and I appreciated their discussion of the scientific findings. For example, I have hypothesized that, via ongoing experiences, an infant brain begins to develop the capacity to construct predictions, so I was delighted to learn about research by Rovee-Collier and colleagues. Overall, however, I found Sullivan and Minar's evaluation of the theory of constructed emotion less helpful because they misunderstand the theory in fundamental ways.

Confusing Affect and Emotion

Sullivan and Minar suggest that the theory of constructed emotion “dismisses the role of affect in the considerable nonverbal and social experiences occurring in the first year,” a mistake that is somewhat perplexing given the very central role that affect plays in the theory. Several chapters in *How Emotions Are Made* (following numerous published research papers) discuss affective feeling as an inborn, core capacity deriving from interoceptive sense data from the body. Affect is firmly tied to the allostatic regulation of an infant by his or her caregivers (i.e., it is shaped by social experiences) and is therefore a key ingredient for developing the emotion concepts that

later arise (Atzil, Gao, Fradkin, & Barrett, 2019). Sullivan and Minar's hypothesis that “predictions are not ‘cold’” is supported by the available neuroscience evidence (some reviewed in Barrett, 2017), and their speculation that affect and interoception “tag” external events during learning (i.e., that learning is multimodal) is also discussed in *How Emotions Are Made* (as well as in other published papers). So, there is no disagreement here. The appearance of conflict arises because Sullivan and Minar appear to have made the common mistake of assuming that affect and emotion are synonymous, which they are not. They refer to affect as “preconceptual feeling aspects of emotion,” which is not quite correct. A brain is always predictively regulating a body, i.e., attempting to maintain allostasis, and is always receiving sense data from the body, and so affective feelings are a basic feature of consciousness – they are not specific to instances of emotion. We learn to transform affective feelings into instances of emotion in those moments using conceptual knowledge that we acquire via cultural learning, and in our culture, instances of emotion are constructed when affective feelings are intense. So, a basic question of emotional development is how do infants and young children learn to make those transformations? This is a basic question about the development of meaning-making capacities.

Confusing Concepts and Words

Sullivan and Minar mistakenly equate “conceptual” and “verbal,” characterizing the theory of constructed emotion as a “view that all ‘emotion experience’ is conceptual and verbal.” The theory of constructed emotion does not *define* emotion concepts as “verbal.” *How Emotions Are Made* and subsequent papers (Hoemann et al., 2019; Hoemann, Devlin, & Barrett, 2020; Hoemann et al., 2020) do discuss the hypothesis that words are powerful cues for learning abstract concepts like emotion concepts. To suggest that words are powerfully linked to how humans develop and transmit abstract mental concepts via cultural inheritance is not equivalent to suggesting that words are *necessary* or *sufficient* for doing so, and it is a mischaracterization to claim this. But the error is understandable – I have focused on unpacking the role that words might play in the development of mental life, precisely because it so violates our normal subjective experience and remains a relatively unexamined topic in the research on emotional development. It is important for developmentalists to appreciate that the learning problem faced by young infants, when it comes

to the domain of emotion, is much more complex than previously assumed. There is very good evidence that infants are equipped for this complex learning from a very early age: listening to human speech, even in infants too young to speak, supports core cognitive abilities (see the wonderful research by Sandra Waxman; e.g., infants as young as 3 months link words with object categories, Ferry, Hespos, & Waxman, 2010). Receptive language influences category development in infants as young as 6 months of age (e.g., Bergelson & Swingley, 2012). And there is ample evidence, reviewed elsewhere (Hoemann et al., 2019; Hoemann, Wu et al., 2020) that words support abstract concept learning. An emphasis on the potency of words is an invitation to researchers to study how words for mental features and events might influence the acquisition of complex mental concepts and categories and should not be understood as a claim that words are necessary for a brain to make a concept (as the research on conceptual combination clearly demonstrates).

Confusing Meaningful Variation with Random Error

There are other examples of deep misunderstanding in Sullivan and Minar's commentary. For example, I do not "strongly reject that certain human facial expressions reflect differentiated emotion states" (Barrett et al., 2019). The paper in question, written with four other senior scientists with diverse backgrounds (one of whom is an expert in emotional development), outlines a consensus po-

sition: human facial movements during instances of emotion are meaningful, but they are much more variable and context specific than previously assumed. For example, people in Western cultures scowl about 30% of the time when angry, meaning that people move their faces in other, meaningful ways the other 70% of the time. And people often scowl when not angry. The evidence suggests, then, that people scowl with low reliability and low specificity when it comes to anger – scowling is one of many expressions of anger, and sometimes, a scowl signifies some other meaning. The evidence is similar for frowns, smiles, wide-eyed gasping faces, and all the other facial stereotypes that have been proposed as universal, prototypic expressions of emotion. Facial movements are not random, and they often reflect differentiated emotion states, but they are much more situated in their meaning than previously assumed (as predicted by the theory of constructed emotion).

Conclusion

The theory of constructed emotion is controversial because its ontological assumptions differ from those typically found in mainstream psychological science. This makes the theory a prime target for transformational interrogation. Sullivan and Minar's commentary does not offer such an interrogation, however. The research they summarize is consistent with the theory of constructed emotion, even as their understanding of the theory, in certain respects, is off the mark.

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