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Children can create a new emotion category through a process of elimination



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ABSTRACT

This study explored process of elimination as a mechanism by which children come to place several different but similar facial expressions within the same emotion category label. In phase 1, children (N = 92, aged 2–7 years) chose from a small array the facial expression that best expressed a given emotion. On three of the trials, children included three different (but similar) novel expressions as exemplars for a made-up label. In phase 2, the children freely label the three novel expressions – now posed by different posers – with the made-up label. Evidence for use of process of elimination increased with age. In just a few trials, children can form a new conceptual emotion category that includes several different, but similar expressions, demonstrating one way in which children can build emotion categories even when the facial expressions are somewhat different and seen on different persons.

1. Introduction

Children come to see emotions in facial expressions (Camras & Halberstadt, 2017; Camras & Shutter, 2010; Widen, 2013), but whether this ability is innate or acquired is not known. Izard (1994), p. 288 asserted that, “the idea of innate and universal facial expressions that have links with human emotions was given the status of scientific hypothesis by Darwin (1872/1965). Substantial evidence, old and new, supports his hypothesis.” Darwin had suggested not only innate production of facial expressions of specific emotions but innate recognition as well, and hence innate conceptual categories for emotion. Evidence has been offered for this position (e.g., Izard, 1971; Rochat & Striano, 2010; Walker-Andrews, 1997).

Recently, (Nelson & Russell (2016a,2016b) hypothesized and offered evidence for an alternative possibility – one curiously ignored in the literature on children’s recognition of emotion from faces. They suggested that the recognition of emotion from facial expression might not be special, with its own innate mechanism, but just another example of a general developmental mechanism: fast mapping. Specifically, children can use a process of elimination to help figure out which face expresses which emotion. And, indeed, in doing so, children can create conceptual categories for emotions. Imagine a toddler who has already learned that a smile indicates happiness. The toddler slugs a playmate and the caregiver asks the toddler whether the playmate is happy or angry. The toddler knows that a smiling playmate is likely feeling happy, but looks to their playmate and sees a scowl instead of a smile. The toddler then reasons that the playmate’s scowling expression, even if novel to him, must be linked to the other label suggested by the caregiver: angry. The process of elimination occurs when the child eliminates certain possibilities in order to match a novel expression with a novel emotion label provided by the community.

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That children use a process of elimination to match emotion labels to facial expressions echoes considerable research showing that young children use this strategy to learn a range of information. For example, when faced with an unfamiliar color, children use a process of elimination to match a novel label to that novel color (Carey & Bartlett, 1978). Children have been shown to use a similar process for learning about novel objects, shapes, textures, animals, actions, verbally provided facts, and adjectives (Au & Glusman, 1990; Au & Markman, 1987; Baldwin, Markman, Bill, Desjardins, & Irwin, 1996; Bialystok, Barac, Blaye & Poulin-Dubois, 2010; Diesendruck, Hall, & Graham, 2006; Halberda, 2006; Haryu, Imai & Okada, 2011; Heibeck & Markman, 1987; Markman & Wachtel, 1987; Waxman & Booth, 2000, 2001; Waxman, Lidz, Braun, & Lavin, 2009).

The mechanism underlying children's ability to quickly match novel labels to novel objects or information has been extensively debated in the literature. One suggested mechanism is mutual exclusivity – the assumption that all things have just one name (Markman, 1990). A second suggested mechanism is the pragmatic account of word learning – the idea that speakers behave in a cooperative manner during communication and provide relevant information for the listener (Diesendruck & Markson, 2001). A third suggested mechanism is the novelty hypothesis – the idea that children are intrinsically motivated to match novel labels and novel objects (Mervis & Bertrand, 1994). Although these three hypothesized mechanisms reference similar processes, and each mechanism is likely used by word learners at some point in development, the debate in the field continues as to which mechanism is most important and when each mechanism is employed. What is apparent, however, is that children's use of a process of elimination strategy to learn about novel expressions fits with other developmental skills they already possess.

Much has been written on facial expressions of emotion and their recognition. One reads about the happy smile, the angry scowl, and the disgusted nose scrunch. What is less emphasized is that, of course, the specific expression seen for a given emotion varies from one expresser to the next. Importantly, even those who predict that facial expressions are generated similarly in all cultures hypothesize a variety of muscle movements within each emotion category. Thus, the specific set of muscle movements alleged to convey one emotion varies from case to case. There are different smiles, scowls, and nose scrunches. Ekman, Friesen, and Hager, 2002 listed two different happy smiles, seven different angry scowls (each with major variants), and six different disgusted nose scrunches.

Nelson and Russell's (2016a,b) evidence suggested that children can use a process of elimination to create an association between a novel expression and a novel label, although the evidence was preliminary. The novel expressions used were identical across posers. Thus, the evidence did not address the generalizability of the acquired expression-label association to new expressers and to various muscle configurations within the same category. It is thus possible that, in the evidence offered, the child learned that the made-up label (in those studies, pax or tolen) applied to only one specific muscle configuration. That is, much as a child might associate the name Tommy with one playmate with that name (or to a very limited number of playmates), perhaps pax applies only to a very specific version of the expression seen on that occasion shown by a limited number of people. If so, the process of elimination hypothesis would be unable to account for the breadth of expressions children learn to associate with a single emotion, such as learning to link the variety of scowls they see to the single category labeled angry. Thus, a process of elimination would play at most an extremely limited role in the normal developmental process by which children acquire labels for the emotions seen in facial expressions. In that case, the argument for recognition of emotion categories from facial expressions being special would be strengthened. Conversely, evidence that children use a process of elimination more broadly, to label different expressions seen on the faces of different persons, would strengthen the case that process of elimination is sufficient to account for that acquisition.

In the present study, we examined made-up labels (pax and tolen) and three different novel facial configurations posed by three female posers. The novel expressions each involved movements of the mouth not previously associated with any emotion: lower lip depressed, lips puckered, and lips funneled. Although these novel expressions were produced using three different muscle movements, they all resulted in forming the mouth into roughly an oval shape, thus closely mimicking the variable expressions children see in others during daily interactions – for example the many different angry scowls listed by Ekman et al. (2002).

During the experiment, children were presented with two phases. The first, “acquisition,” phase consisted of nine trials. On each trial, the child was shown an array of three facial expressions and was asked to find the one that expressed a certain emotion. On our hypothesis, this phase provided the opportunity for the child to use a process of elimination to match the novel expressions with the made-up label. Presented alongside each novel expression were two foil expressions – happy and sad – thus maximizing the likelihood that even the youngest children knew the foil's appropriate label (Widen, 2013). Next, in the “use” phase, the child was shown the various facial expressions, presented one at a time, and was asked to label the emotion conveyed with any label they wanted. The muscle configurations of these expressions were the same as those used in the acquisition phase, but were posed by a different female poser than the expressions the child had seen earlier. This phase provided the first test of the hypothesis that children generalize across the different expression configurations and to persons on whom the specific configuration had not been previously seen.

Our more general interest is the development of children's understanding of emotional faces, but the literature provides little basis for specific developmental changes in the use of process of elimination applied to faces. It is well known that the ability to name emotions from faces improves gradually with age (Widen, 2013), with children's skills increasing rapidly between four and eight years of age, but the mechanism of change is not known. Conceivably, use of process of elimination improves with age, as demonstrated with a single expression by Nelson and Russell (2016a); Nelson & Russell, 2016b), but just as conceivably it disappears as the child's familiarity with facial expressions increases. We therefore included a broad range of ages to explore this question.

2. Method

The study was approved by the [blinded] Institutional Review Board: Project Title: Chromium; IRB Protocol Number: 17.001.01

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