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10.7 THE WEB OF EMOTION UNDERSTANDING IN HUMAN INFANTS

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Emotions play an important role in our social lives, starting from birth. Most research on infants' emotion processing explores their perception of other people's facial and vocal expressions. These perceptual skills are, however, only one strand in the larger web of emotion understanding. A more complete theory of infant emotion processing requires consideration of the meanings preverbal infants assign to these expressions and how emotions influence infants' interpersonal engagement with others.

There is a wealth of information that can be conveyed via another person's emotional expression—information that is relevant to our general well-being and to the success of our social interactions. Imagine standing in a friend's backyard: The neighbor's dog jumps over the fence and gallops toward your friend. Your friend screams. Her emotion communicates how she feels ("terrified"), how she interprets the stimulus ("vicious animal"), and also predicts her impending action ("she will run!"). This information may then impact our own appraisal of the dog and how we will act in this situation. Emotions can also provide clues about the other person's psychological makeup and can guide

our subsequent interactions with that person. Your friend's display of fear provides insight into her: (a) preferences ("She doesn't like dogs . . . so I won't buy a puppy on her birthday"); (b) goals ("She wants to escape the dog; now is not the time to request a tour of the garden"); (c) future emotional reactions ("She will be happy if I remove the dog"); and (d) more enduring traits ("She is a fearful person; I won't take her to a horror movie"). This illustrates the richness of adults' emotion processing based on thin slices of observed behavior.

What about infants? Here we describe new discoveries about emotion processing in infants. We describe five key strands in the web of infant emotion understanding, based on newly emerging work. These new data reveal the existence of a surprisingly rich understanding of emotions prior to the time that children can engage in verbal reasoning about emotions.

PEOPLE AND THINGS: INFANTS USE OTHER PEOPLE'S EMOTIONAL EXPRESSIONS TO EVALUATE OBJECTS

Infants can use other people's emotional reactions to evaluate objects, termed "social referencing." By 12 months of age, infants avoid a novel object when it is the target of their social partner's negative affective display, but they will readily interact with that object if the person expresses positive or neutral affect (Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992). Infants take their partner's affect into account when appraising the novel object (Saarni, Mumme, & Campos, 1998). When their social partner expresses fear, infants interpret the object as "bad" or "dangerous," and adjust their behavior accordingly. Moreover, as stimulus ambiguity increases, infants become more motivated to seek out another person's reactions and more receptive to the emotional information (e.g., Tamis-LeMonda, Adolph, Lobo, Karasik, Ishak, & Dimitropoulou, 2008). When the experimental stimuli are easily appraised (low ambiguity), the same emotional signal has little or no impact.

These modulations suggest that infants' behavioral regulation cannot be wholly reduced to direct emotional contagion. From a contagion perspective, the other person's expression directly modifies infants' own affective state (e.g., a fearful expression causes the infant to become scared, which in turn inhibits their object exploration).

If infants are restricted to "catching" the other person's emotion via contagion, then they should regulate their behavior regardless of the extent to which the target object is ambiguous. That is not the case, however. Although there is some evidence that infants display more negative affect in response to negative than to positive or neutral displays in social referencing situations (Mumme, Fernald, & Herrera, 1996), such findings do not contradict an appraisal explanation. If infants understand the meaning of their social partner's emotional display and use this as one stream of information to evaluate the novel object, this may change their affective state (e.g., if infants view the object as "dangerous," they may then become fearful).

The two mechanisms—appraisal and contagion—are not mutually exclusive, and the extent of their involvement in social referencing may vary as a function of age, context, and the particular emotion displayed. It is possible that young infants, because they are less adept at regulating emotional arousal, are especially susceptible to contagion. Contagion may be attenuated as the toddler begins to understand the source of another person's emotional reactions (e.g., that "expression X is in response to object Y"; see Repacholi, 1998). It may be easier to regulate one's own emotions and produce an adaptive behavioral response when the source is readily identifiable. In addition, some emotions may be more likely than others to elicit a behavioral response in the infant due to their unique psychophysical and neurobiological features. For instance, the naturalistic fear expression typically employed by researchers involves an initial gasping vocalization that is abrupt, loud, and high-pitched. This in itself may elicit a startle response and subsequent behavioral inhibition in a young infant.

EMOTIONAL EAVESDROPPING: INFANTS' SOCIAL LEARNING AND USE OF EMOTIONS TO PREDICT PEOPLE'S FUTURE BEHAVIOR

In the social referencing situations described here, infants use another person's emotional displays to learn about objects. Can infants also use emotional displays to make predictions about a person's future behavior? This issue was addressed in an "emotional eavesdropping" paradigm wherein infants were merely bystanders, observing a social interaction between two adults. One of the

adults expressed an emotion toward the other adult (Repacholi & Meltzoff, 2007). Importantly, the infant was not the intended recipient of the emotional communication; the emotion was directed away from the infant toward someone else. Can infants learn from “eavesdropping” on emotional interchanges and use the emotional information to predict the future behavior of the emoting adult?

In our studies, infants watched an adult Experimenter performing actions on objects. An adult Emoter expressed anger toward the Experimenter in response to her action—as if it were a “forbidden” act. Infants were then given the objects to play with while the Emoter looked toward the infant and remained silent and neutral. Fifteen- and 18-month-old infants who observed the Emoter’s angry reactions were significantly more hesitant to play with the objects than infants who had been exposed to neutral interactions (Repacholi & Meltzoff, 2007; Repacholi, Meltzoff, Rowe, & Spiewak Toub, 2014). The Emoter’s anger did not seem to impact infants’ own affective behavior, as might have been expected from a purely emotional contagion viewpoint. Instead, infants understood that the Experimenter’s handling of the objects made the Emoter angry and expected the Emoter to get angry at them as well if they handled the same objects in the same way.

Emotional eavesdropping is important in everyday life. One can learn a lot about the social and physical world by observing how people emotionally respond, even when those emotions are not directed at oneself (hence the term “eavesdropping”). Indeed, emotional eavesdropping will often enable infants to avoid the negative outcomes that might otherwise arise if they simply explored new objects and tried new actions without taking into account the emotional reactions of others in the environment.

EMOTION AND ATTENTION: INFANTS INTEGRATE MULTIPLE PERCEPTUAL CUES TO PREDICT PEOPLE’S EMOTIONAL REACTIONS

When predicting another person’s emotions, it is often important to take into account that person’s visual experiences—what they can see. For instance, we might know that our friend gets annoyed when people play games on her laptop, but what if our friend is currently out of the house or looking somewhere else and cannot see the

event? We might exploit this situation because we appreciate that our friend is likely to become angry *only if she sees* us using her computer. Emotions and attention are importantly bound together.

Do infants likewise understand how a person’s visual experiences are linked to their emotional reactions? We explored this by manipulating whether a previously angry Emoter could either see or not see what the infant was doing (Repacholi, Meltzoff, & Olson, 2008). After her emotional interchange with the Experimenter, the Emoter (now neutral) faced infants but read a magazine or had her eyes closed during the response period when infants were given the objects. In these situations, infants eagerly played with the objects. On the other hand, if the Emoter had previously expressed anger *and* she was currently looking in the infants’ direction, infants were loath to play with the objects. This pattern of results is also not reducible to direct contagion. If infants had simply caught the adult’s negative affect, then they should have been hesitant to play with the objects regardless of what the Emoter could or could not see. Instead, infants took into account the Emoter’s emotional history and her current visual-attentional status to predict that she would get angry at them *only* if she saw them playing with the object. This ability to integrate multiple social cues can ultimately enable infants to make more accurate inferences about other people’s future emotions. It is also a step towards the adult state in which perceived emotions form part of a larger pattern of cues for understanding people and things.

EMOTIONAL DISPOSITIONS: INFANTS ATTRIBUTE PERSONALITIES TO OTHER PEOPLE

When we meet someone for the first time, we quickly form an impression about their psychological characteristics. Among the most important trait attributions made by adults are those that refer to other people’s *emotional* dispositions (e.g., “jovial,” “quick-tempered,” “morose”). The attributions that we make about other people’s emotional dispositions guide our everyday and professional behavior.

An emerging literature indicates that infants make trait-like attributions about people’s emotions. We adapted the emotional eavesdropping paradigm to determine whether infants are able to infer that an individual is “anger-prone” (Repacholi, Meltzoff, Spiewak Toub, & Ruba, 2016b). In the observation phase, infants participated in eavesdropping trials to

provide them with an opportunity to learn about the Emoter's propensity for anger. In a subsequent generalization trial, the Emoter did not see the Experimenter acting on a new object. Thus, no emotion (anger or otherwise) was ever expressed by the Emoter or perceived by the infant. In this crucial generalization trial, infants were loath to play with the new object. Infants behaved as if the Emoter continued to be anger-prone—they expected her to get angry again if she saw them playing with the new object.

This suggests that infants make attributions about other people's emotional tendencies or dispositions. Of course, in order to determine whether infants' emotion attributions are fully "trait-like" in the adult sense, researchers will need to explore whether these attributions endure over time and are stable across diverse situations. Temporal and contextual stability are hallmarks of mature trait reasoning (Ross & Nisbett, 1991) and distinguish emotional traits from moods (Ekman, 1994).

WAR AND PEACE: INFANTS APPEASE ANGER-PRONE PEOPLE

The attribution of emotional dispositions has important social consequences. When we observe a person expressing anger toward another individual, we may view the Emoter as being antisocial, unsympathetic, and domineering. Moreover, we may form negative expectations about how this person will treat us. How do infants respond when an individual with a history of becoming angry at other people initiates a social interaction with them?

In one study, we began with eavesdropping trials to provide infants with information about the Emoter's propensity for anger or neutral affect. The (now neutral) Emoter subsequently interacted with infants and asked them to give her some toys (Repacholi, Meltzoff, Hennings, & Ruba, 2016a). What will infants do when confronted with the anger-prone Emoter? Remarkably, infants tried to appease the Emoter. By quickly giving the Emoter what she wanted, infants engaged in behavior that may have been designed to prevent them from becoming the target of the Emoter's anger.

Infants observed the Emoter's propensity for anger in the context of her interacting with another adult, and then generalized that disposition to a new social situation. This cross-situational stability suggests that infants did not view the Emoter's anger as being driven purely by external situational factors (e.g., "she's angry because she

doesn't like this particular Experimenter or this particular set of objects"). Instead, infants behaved as if they expected the Emoter's angry disposition to be consistent across different contexts, and they sought to appease her before she got angry at them, again suggesting "trait-like" attributions by the infants.

BROADER IMPLICATIONS FOR CLINICAL CHILD PSYCHOLOGY

Human infants, prior to understanding spoken language, know a good deal about the interconnected web of emotions. One additional broader point is that other people's emotions serve a self-control function during infancy. We speculate that infants' ability to use others' emotional signals for self-regulatory purposes may be a foundation for later moral development and the child's eventual internalization of societal values. Infants who fail to regulate their behavior in response to an *external* source of control (e.g., others' emotional signals) may experience difficulties later on with the *internal* regulation of their conduct. During the preschool period and beyond, they may be less likely than other children to comply with adult prohibitions in the absence of continued external monitoring. Good assays of infant emotion understanding could lead to the early identification of toddlers who are at risk for later conduct problems.

The findings are also significant with respect to the child clinical literature. The term *hostile attributional bias* is used to describe the tendency to over-attribute hostile intentions to others and to inaccurately interpret the behavior of others as threatening (Dodge, 2006). It has been argued that children's experiences with frequent and/or intense parental anger (observed, or directed toward the self) contribute to the formation of this bias. This bias places children at risk for behavior problems. The hostile attributional bias is assumed to be a late-emerging mindset about the social world. To date, none of the empirical work has included longitudinal studies from infancy. Based on our results, we hypothesize that chronic exposure to parental anger may warp infants' early person attributions and expectations, leading to a distorted emotional world-view. Infants and young children who over-attribute anger and other hostile emotions to others may (tragically) elicit such behavior in a vicious emotional cycle.

Related to this, when children are the frequent target of their parent's hostility (as is the case in physical abuse), this leads to alterations in their emotion processing (Pollak & Sinha, 2002). It is an

open question whether these negative experiences also impair young children's ability and/or motivation to use other people's emotions for adaptive, self-regulatory purposes.

CONCLUSIONS AND FUTURE RESEARCH

A fundamental distinction in the emotion literature is the difference between emotional expression and emotional interpretation. Ever since Darwin, it has been accepted that the *expression* of emotions emerges in infancy and has signal value. The new research with infants suggests that *interpreting*, attributing, and acting on the basis of other people's emotional expressions may also emerge early and be an integral part of what makes us human.

There are crucial questions that remain to be addressed to advance our understanding of the roots of this preverbal emotion processing. How early in life are infants able to assign meaning to other people's emotional signals? How does this capacity develop and transform in the context of the infant's sociocultural and family experiences? How should we characterize the preverbal web of emotion understanding: Are infants merely reading emotions at the expressive-behavioral level, or do they have a psychological conception of emotions—understanding that these expressions are external manifestations of internal and invisible feeling states? By addressing these questions, we can elucidate how the infant web of emotions provides a building block for the more complex, subtle, and deeper understanding of emotions held by adults.

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