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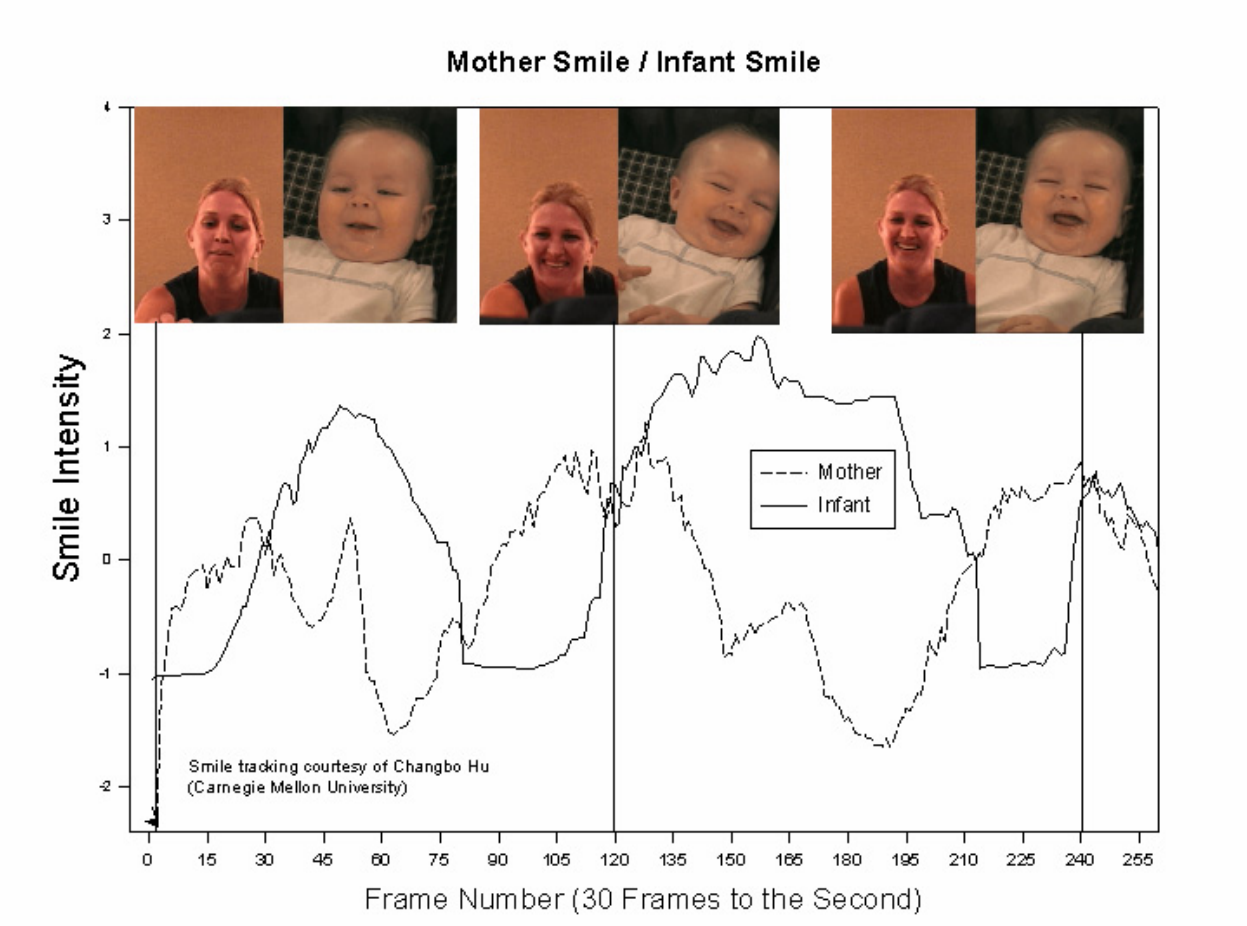
Infant smiles are a prototypical expression of early joy. They are a window on the development of positive emotion. Smiles not only communicate positive engagement and happiness, they also elicit positive engagement and happiness in those around the infant (see Figure). This interactive process of being positively engaged with another may be part of how joy and social competence develop. Early smiles also help to predict later development.



PREDICTION

Infant smiles – particularly smiles in response to ambiguous stimuli - tell us about how infants will develop. Four-month-olds who smile more in response to a mobile, show a more exuberant temperamental style at four years when they are more likely to talk and engage with

peers. Infant smiling in response to a brief period of parental non-responsivity – when the parent stops normal play to pose a "still-face" - may index a certain emotional resilience. In comparison with infants who did not smile, six-month-old infants who smile during the still-face are more likely to be securely attached at twelve months. Their parents also perceive them as having fewer externalizing behaviors such as being loud and rough than infants who did not smile during the parental still-face. Infants who smile when the going gets rough appear to develop socially appropriate relationships. But exactly what is a smile?

WHAT IS SMILING AND HOW DOES IT DEVELOP?

The zygomatic major muscle pulls the corners of the kips upward and sideways to form a smile. Newborn infants typically smile during states of active sleep though infrequent smiles occur in non-sleep states as well. These early smiles sometimes have a relatively mature form but occur against a backdrop of frequent lip and mouth movements. Through one month of age, smiles often occur during states of drowsiness when they are elicited by high-pitched tones. Blind infants also develop smiling during this period. After one month, smiles among sighted infants are increasingly elicited by visual stimuli such as gazing at a face or an image of a face. These smiles are thought to occur when the infant experiences a sudden relaxation in cognitive tension related to recognizing the visual stimulus.

It might seem advantageous for newborn infants to gaze at their parents and smile at them shortly after birth. But this activity – known as social smiling – does not develop until the second month of life. Social smiling signals the infant's active, positive participation in the relationship. Social smiling between 2 and 6 six months is often studied during face-to-face play with a parent (see Figure). The development of infant smiling in interaction involves both changes in the timing of smiles and in the form of the smiles themselves.

The Timing of Smiles

In early interaction, infants tend to smile (often repeatedly) while gazing continuously at their parent. The infant's positive affect - represented by the smile – appears to be dependent on continual visual contact with the parent. Between three and six months, infant smiling becomes less dependent on the parent. Infants are more likely to initiate smiles while the parent is neither smiling nor vocalizing. Infants continue to smile during a gaze at the parent but become more likely to gaze away from the parent during the course of the smile. This suggests that infants are increasingly controlling their own positive emotion by exercising control over both the onsets and offsets of their own smiles.

During face-to-face interactions, infant smiles are often the high point of play and may be avidly sought after by the infant's parents, relatives, and friends. Parents tend to respond to the infant's smile with a smile of their own. A parent smile makes the infant smile more likely, but certainly does not guarantee that the infant will smile. Paradoxically, infants will be more likely to smile if they are allowed time to not smile. When playing with infants, it is important to be alert to the infant's timing. Infants need time to disengage, turn-away, and then look back at the person they are playing with.

The Form of Smiles and the Intensity of Positive Emotion

Infant smiles appear to be part of a process of feeling and expressing positive emotion. Infant smiles tend to occur in response to situations expected to elicit positive emotion such as peek-a-boo games. Smiles are recognized as expressions of positive emotion (even among infants with serious facial deformities). Some smiles, however, are more joyful and positive than others. Infant smiles that involve the raising of the cheeks around the eyes – the Duchenne smile, a smile of joy in adults – involve patterns of left frontal brain activity thought to be associated

with joyful engagement. Infant smiles involving mouth opening also seem to involve particularly strong joy and arousal.

Smiles that involve both mouth opening and cheek raising involve the strongest smiling actions. These smiles are perceived by adults (including the parents of young infants) as more emotionally positive than other smiles. They also are more likely than other smiles to occur when the infant is gazing at its smiling parent. This likelihood grows as infants approach six months. So the form of infant smiles as well as their timing changes with development. Just as infants exercise more control over when they smile between three and six months, they also become more capable of using very intense smiles to participate in highly arousing social situations.

Vocalizations and laughter are another index of emotional intensity. When a vocalization occurs with a smile, it tends to begin during the smile and end before the smile finishes. Laughter is a smile-linked vocalization that becomes more common between 4 and 12 months when it may signify the most intense positive emotion. Smiles and laughter accompany both physically stimulating games like tickling (which is similar to the play-aggression games of non-human primates) and visual or psychologically stimulating games like peek-a-boo. Infants in the first year of life, take an increasingly active roles in games like these and, more generally, in all types of interaction. This increasingly evident agency might be seen as the smiles and laughs as the infant herself, rather than the mother, uncovers the mother's hands from the mother's face in a game of peek-a-boo.

Through six months of age, infant smiles reflect here-and-now emotional interchange with a partner. By 12 and 15 months, infants are intentionally communicating to the partner about objects. How does this development occur? Anticipatory smiling – in which infants smile at an object and then gaze at an adult while continuing to smile – may be the first step.

Anticipatory smiling rises sharply between 8 and 10 months. Anticipatory Smiles seem to communicate that the infant wants to share with the adult a funny experience the infant had with a toy. These may be among the first types of communicative reference in which the infant seems to be referring to an object or experience by expressing something like, "that was a funny toy, wasn't it?"

Theorists like Alan Sroufe see smiling as a response to tension reduction, a type of arousal regulation linked to a decrease in heart-rate. This helps explain similarities in a young infant's smiling response to a relatively unfamiliar face and an older infant's smiling response to mother walking like a penguin. Both involve tension in trying to understand an event, and then sudden relaxation as the event is interpreted as having safe, familiar, and interesting elements. This interpretation is similar to the idea that joy and smiles arise when a desired goal is attained faster than anticipated. One difficulty with these ideas is that arousal is hard to measure (heart-rate is sensitive to many factors) and that young infants often do not have clear goals. It is possible, however, that even in the pell-mell of play, infants are responding to interesting and arousing events which the infant has a role in creating. The infant may smile and laugh as part of the realization that these events, though arousing, are safe and part of larger patterns which the infant is in the process of interactively creating with a partner.

Both smiles and the joyful processes to which they are linked rise and fall in time. It is thought that at a moment-to-moment level, infant and parent are continuously communicating, sharing, and creating emotional information. Specifically, infant expressions of joys are mirrored and intensified by the parent, and the infant responds to this intensification with either intensified engagement or disengagement. New developments in computer vision are allowing researchers like Jeffrey Cohn to explore these real-time interactive dynamics (see Figure). Computer-vision

and other automated tools for measuring smiles will allow researchers to understand how infants and parents create joyful moments together. They will also shed light on differences between infants and parents in how they respond to one another emotionally through smiles.

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Recommended Readings

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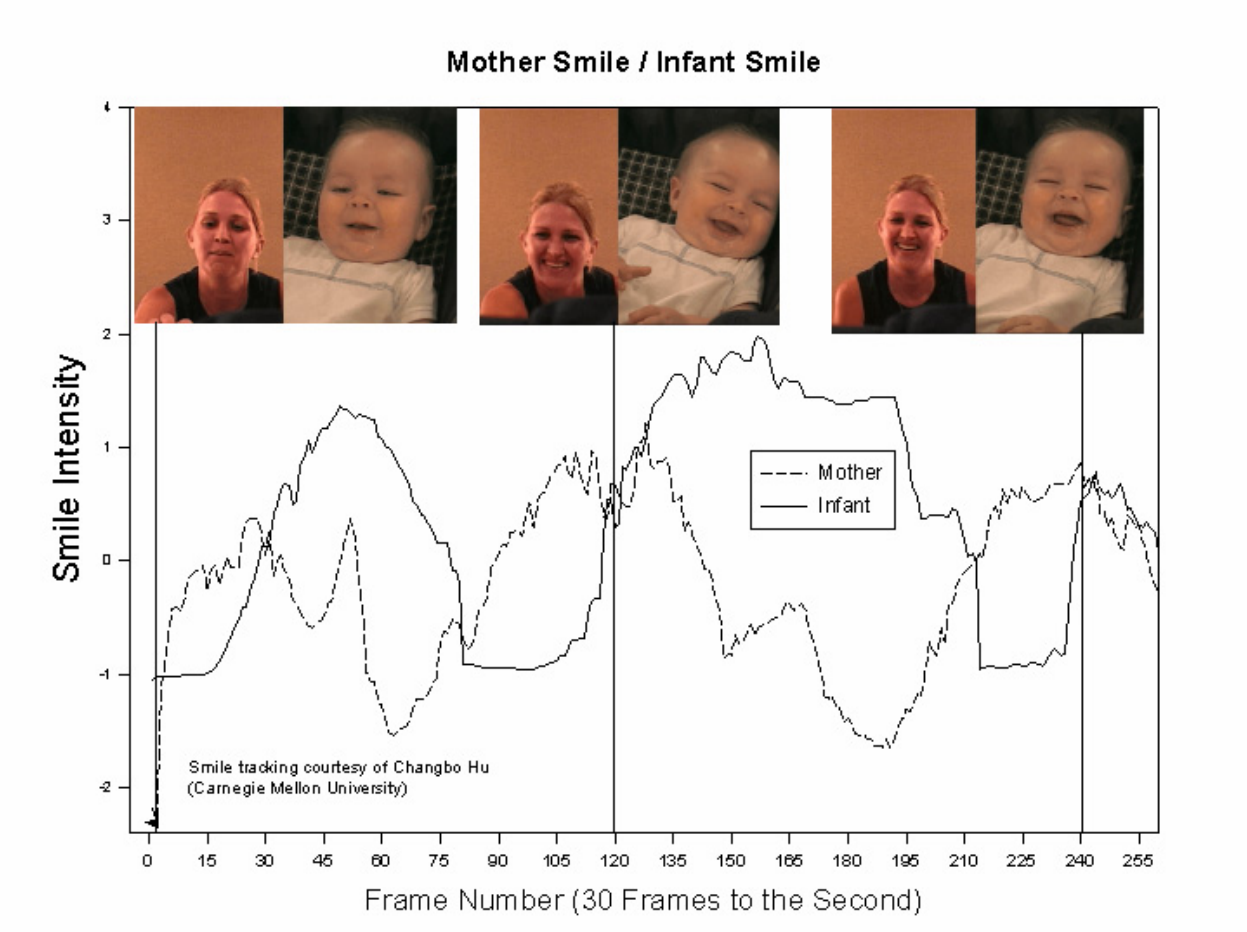
Websites

The Automated Face Analysis website at the Carnegie Mellon University, Robotics Institute, http://www-2.cs.cmu.edu/~face/index2.htm


Mother Smile / Infant Smile
Smile Intensity
Frame Number (30 Frames to the Second)
Mother
Infant
Smile tracking courtesy of Changbo Hu
(Carnegie Mellon University)
0
15
30
45
60
75
90
105
120
135
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165
180
195
210
225
240
255
-2
-1
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3