How do infants experience caregiving?

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ABSTRACT: Almost all of human infants’ experience and learning takes place in the context of caregiving relationships. This paper considers how infants understand the care they receive. We begin by outlining plausible features of an “intuitive theory” of care. On this intuitive theory, caregiving has both a distinctive foundational structure and distinctive features that differentiate it from other social relationships. We then review methods and findings from research on infants’ understanding of people and social relationships. We propose that even before infants can use language, they may understand caregiving as an abstract intuitive theory with some features in common with the adult theory. In particular, infants understand care relationships as intimate, altruistic, and asymmetric. We review work that starts to shed light on this proposal, including that infants distinguish between intimate relationships and merely positive ones, and that they have asymmetric expectations of responses to distress in intimate relationships that occur between large and small individuals. The proposal that infants can make these inferences has societal and political implications for how we structure caregiving in early life.

I.

We are alive today because we received a tremendous amount of care when we were young. Human infants couldn’t survive otherwise. Compared to other species, we are born especially dependent on our caregivers and our infancy is especially long1. However, it is certainly possible to receive care without understanding it. (For almost all human history, we have received oxygen without understanding it.)

What do infants understand about the care that keeps them alive? At one extreme, we can imagine an infant who comes to the world with very little to no knowledge. Like all infants, she would regularly experience aversive states (e.g., hunger, discomfort, fear, sleepiness). Over time, she may learn to predict that some of her actions (e.g., screaming) and sensory experiences (e.g., adults’ faces or voices, or being lifted) are associated with relief. She could even change her behavior to influence what will happen. This would require no understanding of entities (e.g., ‘mom’, ‘me’), causes (e.g., ‘mom responds because she cares’), or relationships (e.g., ‘mom is connected to me’). She would simply understand that when she reacts to these aversive states with certain actions (e.g., crying), it predicts that other things will follow (e.g., a human face appearing).

At the opposite extreme, we can imagine an infant who understands the caregiving relationship as an adult observer would. An adult would see two entities, both living creatures, with desires, goals, and abilities. The two creatures would appear to be in a stable and enduring intimate relationship with one another. The relationship would appear asymmetric, not egalitarian: One creature is more capable than the other, which is made obvious by its physical attributes, including its larger size. Moreover, the relationship is altruistic – an adult observer would expect the larger creature to use its superior physical abilities to provide for and support the smaller one and may even think it is wrong if the larger creature fails to do so.

It may seem obvious that the experience of infants receiving care would be more like the first description: that the infant’s experience of caregiving would be limited, concrete, and sensory. That is, infants would lack the abstract relational interpretations an adult observer uses to understand the interaction. Shouldn’t infants need to learn words like ‘love’ or ‘mom’ before they can understand a parent-child relationship? Don’t infants need to know culturally specific information, since caregiving varies by culture? In this paper, we argue the opposite. We argue that before infants can reliably use language and before they have become experts in their culture, they understand caregiving as a specific type of social relationship. We argue that an intuitive theory of caregiving would allow infants to distinguish caregiving relationships from other relationships--recognizing that they are asymmetric, altruistic, and intimate.4 We speculate that this foundational knowledge may be shared across cultures and could act as an inductive bias to support the learning of the many culturally variable ways that kinship and caregiving are organized.3 Recognizing and understanding caregiving could serve as one way (though certainly not the only way) that infants all over the world learn about their social relationships and those around them. It would support learning about their family: both those who act as caregivers (e.g., parents, grandparents, older siblings, close friends) and those who do not (e.g., younger siblings). It would also support learning about their caregivers including those who are family and those who are not (e.g., daycare teachers, nannies, etc.)

In this paper, we first describe what an adult intuitive theory of caregiving may be. Then, we describe research that supports the proposal that our adult intuitive theory is built on infant intuitions about caregiving relationships. Finally, we will consider some of the intellectual, societal, and political implications of this proposal.

II.

A large and influential literature in cognitive science describes our everyday conceptions of the world as intuitive theories. Intuitive theories are systems of knowledge that inform our behaviors, explanations, and understanding of varied situations.4 These theories do not require formal education but instead are the ‘everyday’ way that people think about things. Examples of intuitive theories include theories of the movement and behavior of physical objects and theories about biology, such as the contrast between plants and animals or life and death.5 We use these theories to understand other people. “Intuitive psychology,” also known as “theory of mind,” allows us to understand the actions of others in terms of their beliefs, desires, and intentions. “Intuitive sociology” allows us to make sense of social relationships between individuals (e.g., friend or foe, family or friend, leader or subordinate).6 Elements of these theories seem to be in place even in infants who are less than 6 months old, and provide the foundation for a substantial amount of learning that occurs in early childhood.

We argue that our everyday ideas about caregiving can also be characterized within a larger intuitive theory. An intuitive theory of caregiving would characterize its structure and distinguish caregiving relationships from other social relationships, such as reciprocal relationships or dominance relationships.7

Relationship types can be distinguished by how the people in them coordinate their different goals, capabilities, and resources.8 In reciprocal relationships, A and B can trade off their varying capabilities and resources to accomplish their goals, creating a positive sum game. In dominance relationships, there are asymmetries between A and B, and the fact that A has more resources and capabilities than B leads B to subordinate their goals to those of A. In solidarity or communal sharing relationships, A and B function as a single unit where individuals pool resources, and individual capabilities to achieve collective goals.

We propose that intuitively, caregiving relationships also have a specific structure. The caregiving relationship is not reciprocal or communal. As in dominance relationships, one person is more capable and/or has more resources than the other, but this very asymmetry leads the caregiver to invest time, capacity, and resources into the target of care. The goal in caregiving is not to pool individual capabilities, but often to increase the capabilities of the cared for.

Many social relationships have expectations of reciprocation or ‘tit-for-tat’—I do something for you because I expect you to do something similar for me in return. In relationships between friends or equals, favors are matched by similar favors, and gifts by similarly valued gifts over time. A friend who never took a turn preparing a meal, or suggesting an activity, or sharing a confidence, would eventually erode the friendship. Caregiving, in contrast, does not demand direct reciprocity. A parent may provide meals, suggest activities, and listen to confidences of their child for decades, with no expectation that their child will do the same in return.

A basic distinction between reciprocal relationships and caregiving is that the caregiver has capacities or resources that the cared-for person does not. This asymmetry makes caregiving similar to dominance relationships, where individuals differ in their control of resources through power. However, the consequences of asymmetry in caregiving are the opposite. A caregiver uses their capabilities and resources to accomplish goals that the caregiver believes are in the best interest of the other. This formulation applies to caregiving very broadly—from parents, children, and friends to professional childcare and eldercare workers, teachers, and therapists. In all these cases, the lack of resources becomes the very motivation for the more capable person to spend energy or resources to advance the goals and interests of the other. Often caregiving is necessary because the other person either cannot achieve their goals or fulfill their interests for themself or does not know what is best for them.9

In other cases, however, caregiving requires prioritizing a meta-goal of enabling the other person to (learn to) exert autonomy. For example, in caring for elderly parents, or for mentees or friends, the caregiver may decide to try to help the cared for person achieve their goals, even if the caregiver does not believe that they are in their best interest objectively. For adolescents or students, caregiving may consist of providing the other person with resources that will enable them to be more autonomous and to formulate and achieve new goals of their own. The tensions in these different conceptions of care may play out for caregivers even when they are looking after infants (for example, in decisions about sleep training--letting babies ‘cry themselves to sleep’). An important empirical question is how these tensions play out in intuitive theories of caregiving across contexts and cultures.

Caregiving is characteristically local, involving shorter interpersonal distances than other types of relationships. For example, prototypical acts of caregiving involve direct contact with the other’s body, such as providing food, physical support, and hygiene. These acts can require substantial physical intimacy. Also, caregiving often occurs between people who are closely biologically or legally related. In times of need like infancy, old age, and ill health, it is most often parents, siblings, and spouses who engage in sustained caregiving. Nevertheless, caregiving can extend far beyond biological kinship. Also, in acts analogous to physical caregiving, we provide mental or emotional support for our family, friends, students, patients, colleagues, and neighbors. At least since people have been writing to one another, this type of emotional support can happen over long distances.

These diverse features of caregiving plausibly arise from a coherent intuitive sociology of relationships. Instead of just accumulating beliefs about types of people and groups (e.g., that they are generous or competitive), adults organize their observations of the social world in terms of unobserved but causally central concepts of relationships.10 Using these latent concepts as hypotheses, adults can fluently recognize distinct types of relationships from limited observations, infer features of those relationships that go well beyond those observations, and form predictions for the participants' future behaviors in new situations.11

This informal set of intuitions about caregiving could be formalized as a computational cognitive model. For example, existing computational models qualitatively and quantitatively match people’s inferences of the beliefs and desires that explain others’ goal-directed actions12. The key idea is that human observers treat others’ actions as approximately rational. Given prior beliefs about a person’s possible goals and beliefs, and observation of that person’s possible actions, observers can use Bayesian inference to update estimates of the person’s desires. These models can also accommodate situations in which observers see that a person is acting to achieve another person’s desires. These inferences compose a possible foundation for representing relationships. Alternative hypotheses about the representation of caregiving could be expressed in terms of alternative structures in the latent space of these models. For example, is pursuing the goals of another agent sufficient to imply caregiving? Or must there be evidence of asymmetry and a distinction between intimacy versus affiliation? An advantage of computational models is that they require scientists to make their hypotheses, and their alternatives, fully explicit. Efforts towards such a formal model are underway.

The key question for the current essay, however, concerns the developmental origins of these adult intuitions. We now consider the evidence that the adult intuitive theory of caregiving has its origins in infancy.

III.

One may wonder how we could find support for a proposal about the minds of infants, who cannot yet speak or reliably respond to language. To overcome this challenge, researchers have developed methods that measure infants’ non-verbal behavior, what they look at or the way they act. In particular, researchers measure where and how long infants look at events, scenes, objects, or individuals (e.g., people, animated characters, puppets, etc). 14 These methods reveal systematic patterns both in how long infants look at events (for example, infants look reliably longer at physically impossible than probable scenes), and where infants look (for example, infants look at face-like patterns more than other patterns). Using these methods, researchers have discovered that from an early age, infants know more about the world than has often been imagined. This knowledge guides their attention and helps them make sense of the vast amounts of information they receive through perception. For example, infants recognize and understand basic physics (e.g., that an unsupported object will fall), discriminate quantities (e.g., infants can distinguish between ‘1’ and ‘3’), and recognize ‘agents’ (e.g., people, animated characters, puppets) as beings who have self-generated motion.15

Most relevant to our purposes are studies that use these methods to investigate how infants think about the minds of others. Since minds cannot be directly observed, the key question is whether and when infants understand that people’s actions in their environments reveal aspects of their mental states, such as goals or preferences. We will use one example from this body of work to give a more concrete illustration of how such experiments work: When do infants interpret people’s reaching behavior as evidence of the person’s goals?

In a classic experiment to address this question, infants see a person reach toward one of two objects: for example, an infant might see a person reach for a ball on the right while rejecting a toy bear on the left of the stage (refer to Figure 1).16 This whole sequence repeats six to fourteen times until the infants begin to lose interest. Next, the curtains rise to reveal that the objects have switched locations: now the ball is on the left and the bear is on the right. This is the critical test trial. The person reaches either for the same object, the ball, in its new location on the left; or the person makes the same hand movement to the right and ends up grasping the bear. Researchers measure how long infants look at each of these new sequences. In general, infants look longer at events that surprise them. So, which is more surprising: the new movement to the old object, or the old movement to the new object? Globally, in terms of the patterns of shapes and colors moving on the stage, the new movement to the old object makes a bigger visual change. On the other hand, adults see the movements as evidence of a goal: It is less important which direction the person moves their hand, but rather more important which object they grasp. That is, adults see a person who wants a ball, not a bear. By 5 months of age, infants seem to agree. They look longer (are more surprised) when the person reaches to the right and grasps the bear, than when the person reaches to the left and grasps the ball.

This classic experiment, and many dozens like it, have far-reaching implications. Like adults, young preverbal infants understand people’s movements as goal-driven actions, whose ends are generally more salient than the means. Infants do not need to be specifically familiar with the person, or the objects, to make these inferences: the experiments show infants an unfamiliar stranger reaching for a specific toy the infant has not seen before. Infants can also understand goal-directed actions that they could not produce themselves. In one series of experiments, a small round cartoon character pursues its goals by jumping over a barrier three times taller than itself.17 The 8-month-old infants cannot jump at all, let alone leap over a barrier the size of a semi-truck, but they recognize that the jump is an efficient goal-directed action, and expect the cartoon character to stop jumping when the barrier is removed.

Infants not only observe the surface features of events, like movement and shape but also understand those events in terms of invisible causes like goals. Infants also recognize that the goal is specific to the person. Infants are only surprised if the same person switches from reaching for the ball to reaching for the bear.18 If a new person reaches for the bear, infants are not surprised. Infants do not seem to make these predictions when an inanimate object, like a machine claw displays the same pattern of movements as a human hand. To make these inferences, infants must have a basic idea that a person’s goals are stable. More generally, infants clearly distinguish between events caused by people and goal-directed agents, versus visually similar events that reflect random or physical causes. While people’s movements reflect their own goals, inanimate objects’ movements reveal what caused them.19

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| **Figure 1.** Schematic of stimuli used in the studies described above. [A] First infants see the familiarization events, in which a hand repeatedly reaches for an object. Across these events, the object appears in the same location, so the hand takes the same path. [B] Starting at 5 months, they interpret the reaching as object-directed. Earlier they are open-minded about whether the goal is for a location or an object. This allows them to make predictions about future events. [C] The critical test comes when infants see one of two scenes: the hand takes the same path, reaching toward the same location, or the hand takes a different path and reaches for the same object. [D] Infants look longer at the Same Path scene, suggesting they find this unexpected. Example data set re-recreated using means and reported standard deviations reported in the manuscript.20 |

So far, we have discussed work establishing that infants interpret some actions as evidence of an individual’s goals. But infants go beyond tracking individuals, they also seem to recognize and understand social interactions between two or more individuals. Infants recognize positive or friendly social interactions and competitive or antagonistic social interactions.21 Infants make guesses that two characters ‘go together’ if they speak the same language, synchronize their actions, refer to themselves with the same label, help one another, or imitate one another.22 Infants also infer that groups of three characters ‘go together’ if they make movements that look like a synchronized ‘dance’. 23

Infants also have specific expectations about howindividuals will interact in the future based on their past social interactions. For example, infants expect that if one character imitates another, they will also be likely to help them. In one of these studies, 8- and 9-month-old infants observed three animated characters: a red sphere, a yellow cone, and a blue cylinder.24 In the first scene, the red character looked toward the yellow cone and moved (e.g., jumped up and down). The yellow cone imitated the red character by jumping up and down. Next, the red character looked toward the blue cylinder and made the same movement (e.g., jumped up and down). This time, the blue cylinder made a different movement in response (e.g., spun around). Infants saw these scenes repeated six times, played on a loop until the infants lost interest. Afterward, infants watched the red character move through a narrow pathway that was partially blocked by a barrier. In the critical test trial, one of the two partners from before, either the yellow cone or the blue cylinder, helped the red character by pushing the barrier out of the way. The 8- to 9-month-old infants seemed to expect the imitator (yellow cone) to help: they looked longer at a scene where the non-imitator (blue cylinder) cleared the path than at the scene where the imitator did so. These results agree with many other studies in which infants expect positive social interactions after they observe imitation.25 They are also consistent with a large literature showing that infants themselves imitate in sophisticated ways from a very early age, and that they actively use imitation as a cue to social relationships.26 These findings also suggest that infants already have some expectations that agents who are in a social relationship, as evidenced by mutual imitation, are likely to help each other.

There is also evidence that infants recognize asymmetries in power, particularly in the context of size differences. Infants who see two agents of different sizes assume that the larger character will dominate over the smaller one in a situation where their goals conflict. They make similar inferences when individuals have won in the past, or when they have more allies.27

In sum, infants pay attention to social interactions. By observing who interacts, infants figure out who goes together. They also have expectations about how pairs or groups of people will interact, based on how they have interacted in the past.28 Below we will discuss the implications of these studies for the question of whether infants represent caregiving.

IV.

Based on the studies we have described so far, it is unlikely that an infant’s experience of caregiving is only sensory. Some of the elements of an intuitive theory of caregiving are in place. For example, the infant likely recognizes that the actions of caregivers and the cared for are goal-directed. They also recognize that some relationships between people are closer or more intimate than others, particularly those that involve touch and saliva-sharing. And infants recognize simple power asymmetries, at least as evidenced by differences in physical size. These capacities are part of the foundation infants need to understand caregiving, but on their own do not establish that infants do so in the way we propose. In particular, they do not show that infants weave together the features of intimacy, asymmetry and altruism in the way our characterization of the intuitive theory proposes.

To support this proposal, we need evidence for three additional claims. First, infants distinguish intimate from positive relationships (because caregiving is a distinctively intimate relationship). Second, infants recognize that caregiving is both asymmetric and altruistic – it is a relationship between ‘unequals’, in which a more capable individual supports a less capable one. Three, that infants place themselves in a network of social relationships. We have begun to test each of these claims in our ongoing studies.

The first two sets of studies investigate whether infants distinguish intimate relationships from merely positive ones. Recent work from our lab has looked at whether sharing saliva through activities, such as kissing or food sharing leads infants to infer intimate relationships.29 For adults, such actions seem to be a particularly strong indication of particularly close relationships. Those interactions are also especially likely to take place between infants and their caregivers. We build off prior work showing that infants expect others to provide comfort in some contexts. For example, in one study, infants expected that an adult would approach a crying baby instead of a pile of laundry.30 This expectation arose selectively when the baby was crying and needed comfort: infants did not expect that the adult would approach a laughing baby instead of the laundry. Another set of studies found the same pattern when the interacting entities were depicted by a big and a small, animated oval. When the little oval made a crying noise, infants, with a secure attachment to their parent and those with more responsive parents, were surprised if the big oval failed to approach the little oval.31 Together, these studies show that infants expect comforting to occur, at least in some contexts. In the following two sets of studies, we investigate under which conditions infants expect comforting to occur.

In the first set of studies, we asked whether infants expected specific individuals to provide comfort based on cues of social intimacy.32 Infants, ages 8 to 10 months saw two scenes. In one of the scenes, an actress and puppet had an intimate interaction: they ate from the same orange slice, and thus potentially exchanged saliva. In the other scene, the same puppet had a positive but not intimate interaction with a different actress: they passed a ball back and forth. Next, the puppet was shown flanked by the women from the previous scenes. The puppet began to cry. Infants looked first toward the woman who had shared the orange with the puppet, as though they anticipated that she would respond to the puppet’s distress. But why did infants think that the intimate partner would respond? A core component of intimate relationships is that we direct intimate actions toward specific people. Infants seemed to agree: when the original puppet was replaced by a new puppet who had not been in the initial interactions, infants no longer expected the partner who had previously performed an intimate action to respond. This set of studies suggests that infants recognize intimate social relationships.

In the second set of studies, we investigated whether infants recognize that caregiving is an asymmetric relationship – one that involves one agent who has more power and resources than another.33 In each of the studies described above, the character who is in distress is smaller than the characters who do or could provide comfort. However, it is unclear if these size differences led infants to expect comforting, and what other contextual clues might be necessary. We hypothesized that infants should selectively use size when they also have cues of intimacy. Here, we depicted intimacy with social touch.34 We showed infants a small character, who had the sameinteraction with a larger and similarly small character (refer to Figure 2). In the intimate scene, a small yellow character touched and danced with a large blue character, and a small green character. The yellow character touched and danced with the two other characters. Next, we asked which character would respond to the yellow character’s distress. We found that infants looked first and longer at the large character, suggesting they anticipated the large character would respond. Next, we showed infants the same scenes, but this time the characters danced without touching. Here, infants no longer expected the large character to respond.

This finding suggests that within intimate relationships, infants expect comfort to happen between large and small individuals. Physical size also predicts a person’s role in a caregiving relationship: the more capable (larger) person provides care for the less capable (smaller) individual, but usually not the other way around. To test whether infants understand caregiving relationships this way, we showed infants the same scenes as in the previous study, but in this study, the central character was large. We have found that infants do not expect either the smaller or similarly large character to respond to the large character’s distress. This suggests they don’t have consistent expectations about who will respond to a large character’s distress.35

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| **Figure 2.** Infants saw animated scenes in which either the central character ‘danced’ with the two outer characters [TOP] or scenes in which the central character danced but did not touch the outer characters. We hypothesize that infants use these interactions to make inferences about who is connected, and whether the connection is intimate (in the touching interaction) or positive but not intimate (in the other interaction). We further hypothesize that infants then use size to understand who is in what role. |

An important feature of the intuitive theory we propose is that it applies both to the infants’ own caregiving relationships and to the relationships the infant observes. As a result, infants with something like the adult theory should be able to place themselves within a network of relationships that they learn from observation. To investigate this claim, we built off previous findings in which 15-month-old infants used triadic closure to make sense of social interactions. For example, infants expected two large characters to ‘go together’ if they responded to the same crying small character.36 We investigated whether infants use similar logic when reasoning about their own relationships. These studies build on the work on imitation described above, as well as work showing that infants recognize their own parents.37 In our study, infants saw scenes in which one of their parents vocally imitated one of two puppets. After they were shown this scene six times, they saw a test trial that took advantage of infants’ ability to match visual and audio stimuli.38 In this test trial they saw the two puppets from the interaction with their parent. Both puppets moved their mouths, but only one voice called to them by saying, ‘Hi [Baby’s name]! Hi!’. To measure where infants thought the voice was coming from, we measured which puppet infants looked at longer. During these scenes, infants spent more time looking at the puppet whom their parent had imitated, suggesting they thought that the imitated puppet was the source of the voice. This pattern of looking did not reflect a general interest in the imitated puppet: infants did not spend more time looking at the puppet when the puppets appeared to be calling to a different person: the puppets looked off-screen and called a different baby’s name. But did it matter that it was their parent who had the initial interaction, or would they learn this information from any adult they observed? To answer this question, every infant also saw similar scenes that featured another infant’s parent interacting with two new puppets. In the test trial, infants had no expectations about which puppet would call to them: they looked equally long at the imitated puppet and the puppet who had not been imitated by the unfamiliar adult. This set of studies suggests that infants pay attention to the ways that their parents interact with new individuals to learn about whether those individuals are in their social networks.

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| **Figure 3.** [A]Infants saw videos of their parents interacting with puppets. In the scene, the puppets vocalized nonsense syllables (e.g., ‘eeee, eeee’). Then, the parent imitated one of the puppets but not the other puppet. [B] We propose that infants parse this scene by inferring whois connected by observing the imitation, recognizing their social relationship with their parent, and inferring that they have a social connection to the imitated puppet. They use this knowledge to predict who will socially engage with them. [C, TOP] We measure which puppet infants spend more time looking at during a test event in which the puppets both move their mouths but only one voice calls to the infant. [C, BOTTOM] Graph showing data from one study, white dots are means, lines are medians, gray dots are individual babies’ data. Infants spent more time looking at the puppet who was imitated only after seeing their parent interacting with the puppets. |

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V.

We propose that infants have the cognitive foundations required to understand caregiving relationships, including their own and those they observe. This proposal is based on experimental studies of infants’ patterns of looking at simple events. Based on these studies, we suggest that infants could learn and remember (i) who shared saliva with, touched, and held and comforted the infant themself; (ii) who else these caregivers share saliva with, touched, and held and comforted; and (iii) who shared saliva with, touched, and held and comforted their caregivers. Connecting these observations into a network, infants could form the nucleus of a representation of their own family.

The ability to recognize family based on intimate social relationships could be powerful. For example, infants could use these interactions to recognize important family members, even if they are physically present relatively infrequently. Grandparents or aunts and uncles who live far away, or parents who travel, such as those in the military, could still be identified as core members of the infants’ family network based on the pattern of intimate interactions that infants observe and experience when those people are present.

Reciprocally, the absence of intimate interactions may help infants to identify caregivers who are not part of their family and to form different expectations for future interactions. Paid caregivers, like nannies and daycare teachers, tend to be present very regularly for a period of infants’ lives but perform fewer intimate actions, such as kissing or sharing food, with the infant and especially with her parents.39 If infants discriminate between intimate and non-intimate caregivers, this distinction could help infants accept the temporary and transient presence of paid caregivers. These are speculations and could be directly tested using the methods we describe here as well as more ecologically valid methods that measure what types of interactions infants tend to observe in their everyday lives.

The studies as formulated also do not address the origins of these understandings. Biologically, care is particularly crucial for infants. Moreover, human infants have a particularly wide range of caregivers including “alloparents” who are not necessarily biologically related.40 Thus, infants may be especially sensitive to potential alloparents, and actively behave in ways that recruit care.41 Innate elements of an intuitive theory of caregiving then might be especially evolutionarily adaptive for human infants.

Alternatively, or in addition, the infants’ ecological niche means that experiences of caregiving will be especially frequent and pervasive such that infants couldn't survive otherwise. Thus, an early understanding of caregiving might be the result of applying basic inductive learning mechanisms to these experiences. In particular, we don’t know to what extent these abstract understandings of caregiving are the result of infant’s own caregiving experiences. The large literature on early attachment suggests that infants general understanding of caregiving, their “internal working model,” may be influenced by their own experiences of caregiving. Notably, in prior work the securely attached infants made different predictions about the character’s response to stress than infants with insecure attachments.42

Similarly, a major limitation to the interpretation of these findings, is that the infants in these studies predominantly come from one cultural context: almost all the work we described tested US-American, Canadian, or European infants. The infants in these studies had months of experience with their culture and with their caregivers. Therefore, these findings may not be universal. We propose that the early emerging representations are learning mechanisms—they allow infants to organize the information they perceive in their environment. Cultural practices—such as the ways that intimate relationships and caregiving relationships are substantiated—may influence what type of information is available to these learning mechanisms. For example, in some environments, older siblings or other children are more likely to be caregivers for infants and toddlers. In other environments, saliva sharing is very widespread beyond the family.43 Such environmental variation leaves open questions about how variable infants’ expectations maybe even at these young ages.

For example, if infants are constructing or revising an intuitive model of caregiving we might expect that differences in their experience of caregiving would shape their intuitive theories in different ways. Moreover, since theories are high-level cognitive structures that inform and shape more specific inferences and predictions those differences in theories could have wide-ranging effects on infants’ later beliefs and behaviors. This is congruent with the picture of “internal working models” in attachment theory, which are like intuitive theories. The idea is that the different varieties of attachment behavior -secure versus avoidant versus insecure-- reflect differences in infants’ conceptions of caregiving which may generalize from their particular caregivers. At least one set of studies suggests that this may be true44- infants with different kinds of attachment relationships made different predictions about how a large, animated character would react to the distress of a small, animated character.  In this way, early intuitive theories might play an important role in the surprisingly strong and long-lasting effects of early experiences on later life.  At the same time, the revisability of intuitive theories might provide an important mechanism for resilience and recovery. The general nature of theories is that they shape more specific inferences and predictions and may initially resist counterevidence. But that counterevidence can eventually lead to theory revision.

These data also open questions about how these early emerging concepts relate to adult concepts of caregiving. In other domains, early learning mechanisms persist throughout adulthood. Sometimes initial intuitions make subsequently learning new concepts more difficult. For example, children learn that ‘the earth is round’, but interpret it in the wrong way: many children imagine that the earth is round like a pancake, while others imagine a snow globe with a flat surface and a domed sky. The learning mechanisms that allow all humans to navigate on flat surfaces or make predictions in relation to the laws of gravity make it difficult to understand that the earth is a sphere floating in space, even when people explicitly teach this to them.45 Are there ways that early intuitions about caregiving might interfere, shape, or support later learning? Moreover, like our early conceptions of the earth, are our initial intuitions about care overwritten in light of new evidence?

A particular question is how the intimate character of early caregiving intuitions is related to broader intuitions of the sort that would be characterized by our abstract model. As adults, we can conceive of care for a wide range of others, including, for example, care for the natural world, or care for past or future generations, even though we are unlikely to share saliva or dance with those others, and we can conceptualize care as involving abstract institutions and groups.46 Nevertheless, our general intuitions–such as the fact that we are more obliged to care for close others, or that those with more resources have an obligation to care for those who have less, may be rooted in these more specific early conceptions.

In summary, caregiving relationships are interwoven into the fabric of human life—we cannot survive as infants without them, and they persist throughout the lifespan. As infants, we receive care from a variety of adults. As we get older, we may care for infants, children, pets, aging parents, grieving friends, or ailing spouses. For many people, including nurses, nannies, teachers, and others, caregiving is a profession. For some people, caregiving relationships occur with land, other species, deceased people, or even future generations.47 We propose that understanding caregiving relationships in terms of an intuitive theory that specifies that care is intimate, altruistic, and asymmetrical may shape how people conceive of at least a subset of the interconnected world into which we are born.

ENDNOTES

1Sarah B. Hrdy, *Mothers and Others: The Evolutionary Origins of Mutual Understanding* (Cambridge, Mass.: Harvard University Press, 2009), <https://doi.org/10.2307/j.ctt1c84czb>; Sarah B. Hrdy and Judith M. Burkart, “The Emergence of Emotionally Modern Humans: Implications for Language and Learning,” *Philosophical Transactions of the Royal Society of London. Series B. Biological Sciences* 375 (1803) (2020): 20190499–20190499, <https://doi.org/10.1098/rstb.2019.0499>; Sarah B. Hrdy and Judith M. Burkart, “How Reliance on Allomaternal Care Shapes Primate Development with Special Reference to the Genus Homo,” in *Evolutionary Perspectives on Infancy* (Cham: Springer International Publishing), 161–188, <https://doi.org/10.1007/978-3-030-76000-7_8>; and Courtney Helfrecht, Jennifer W. Roulette, Avery Lane, Birhanu Sintayehu, Courtney L. Meehan, “Life history and socioecology of infancy,” *American Journal of Physical Anthropology, 173*(4) (2020): 619-629, <https://doi.org/10.1002/ajpa.24145>.

2Christina M. Steele and Ashley J. Thomas, “Cognitive Representations of Family,” in *American Psychological Association Handbook of Evolutionary Psychology*, Unpublished chapter; Christina M. Steele, Megan K. Richardson, Azwayla F. Taylor, Denis Tatone, and Ashley J. Thomas, “Early Threads of Connection: Probing Infants’ Early Understandings of Caregiving Relationships” in *CogSci* (in press); and Tomer D. Ullman and Joshua B. Tenenbaum, “Bayesian Models of Conceptual Development: Learning as Building Models of the World,” *Annual Review of Developmental Psychology* 2 (1) (2020): 533–558, <https://doi.org/10.1146/annurev-devpsych-121318-084833>.

3Janet Carsten, “The Substance of Kinship and the Heat of the Hearth: Feeding, Personhood, and Relatedness Among Malays in Pulau Langkawi,” *American Ethnologist* 22 (2) (1995): 223–241, <https://doi.org/10.1525/ae.1995.22.2.02a00010>; Lee Cronk, *From Mukogodo To Maasai: Ethnicity and Cultural Change In Kenya* (Boulder, CO: Westview Press, 2004); Lee Cronk, Dieter Steklis, Netzin Steklis, Olmo R. van den Akker, and Athena Aktipis, “Kin Terms and Fitness Interdependence,” *Evolution and Human Behavior* 40 (3) (2019): 281–291, <https://doi.org/10.1016/j.evolhumbehav.2018.12.004>; Nancy J. Knauer, “LGBT Older Adults: Chosen Family and Caregiving,” *The Journal of Law and Religion* 31 (2) (2016): 150–168, <https://doi.org/10.1017/jlr.2016.23>; Peter Parkes, “Milk Kinship in Islam. Substance, Structure, History,” *Social Anthropology* 13 (3) (2005): 307–329, <https://doi.org/10.1017/S0964028205001564>; Marshall Sahlins, *What Kinship Is-- and Is Not* (Chicago: The University of Chicago Press, 2013); David M. Schneider, *A Critique of the Study of Kinship* (Ann Arbor: University of Michigan Press, 1984); and Nina J. Levin, Shanna K. Kattari, Emily K. Piellusch, and Erica Watson, “‘We Just Take Care of Each Other’: Navigating ‘Chosen Family’ in the Context of Health, Illness, and the Mutual Provision of Care Amongst Queer and Transgender Young Adults,” *International Journal of Environmental Research and Public Health* 17 (19) (2020): 7346, <https://doi.org/10.3390/ijerph17197346>.

4Alison Gopnik and Henry M. Wellman, “Why the Child's Theory of Mind Really Is a Theory,” *Mind & Language* 7 (1-2) (1992): 145–171, <https://doi.org/10.1111/j.1468-0017.1992.tb00202.x>; Joshua B. Tenenbaum, Thomas L. Griffiths, and Charles Kemp, “Theory-Based Bayesian Models of Inductive Learning and Reasoning,” *Trends in Cognitive Sciences* 10 (7) (2006): 309–318, <https://doi.org/10.1016/j.tics.2006.05.009>; Susan Carey, *Conceptual Change in Childhood* (Cambridge, Mass.: MIT Press, 1985); and Tomer D. Ullman and Joshua B. Tenenbaum, “Bayesian Models of Conceptual Development: Learning as Building Models of the World,” *Annual Review of Developmental Psychology* 2 (1) (2020): 533–558, <https://doi.org/10.1146/annurev-devpsych-121318-084833>.

5Susan Carey, *Conceptual Change in Childhood* (Cambridge, Mass.: MIT Press, 1985); and Tomer D. Ullman, “On the nature and origin of intuitive theories: learning, physics and psychology,” PhD diss, (Massachusetts Institute of Technology, 2015).

6Alan P. Fiske, “The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations,” *Psychological Review* 99 (4) (1992): 689–723, <https://doi.org/10.1037/0033-295X.99.4.689>; Lotte Thomsen and Susan Carey, “Core Cognition of Social Relations,” in *Navigating the Social World: What Infants, Children, and Other Species Can Teach Us*, ed. Mahzarin R. Banaji, and Susan A. Gelman (New York: Oxford University Press, 2013), 17-22,  <https://doi.org/10.1093/acprof:oso/9780199890712.003.0004>; Marjorie Rhodes, “Naïve Theories of Social Groups,” *Child Development* 83 (6) (2012): 1900–1916, <https://doi.org/10.1111/j.1467-8624.2012.01835.x>; Laurence Kaufmann and Fabrice Clément, “Wired for Society: Cognizing Pathways to Society and Culture,” *Topoi* 33 (2) (2014): 459–475, <https://doi.org/10.1007/s11245-014-9236-9>; Lawrence A. Hirschfeld, “On a Folk Theory of Society: Children, Evolution, and Mental Representations of Social Groups,” *Personality and Social Psychology Review* 5 (2) (2001): 107–117; <https://doi.org/10.1207/S15327957PSPR0502_2>; and Denis Tatone, “The naïve sociology of resource transfer,” PhD diss, (Central European University, 2017).

7Christina M. Steele and Ashley J. Thomas, “Cognitive Representations of Family,” in *American Psychological Association Handbook of Evolutionary Psychology*, Unpublished chapter; and Christina M. Steele, Megan K. Richardson, Azwayla F. Taylor, Denis Tatone, and Ashley J. Thomas, “Early Threads of Connection: Probing Infants’ Early Understandings of Caregiving Relationships” in *CogSci* (in press).

8Alan P. Fiske, “The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations,” *Psychological Review* 99 (4) (1992): 689–723, <https://doi.org/10.1037/0033-295X.99.4.689>.

9Ruey-Ying Liu, “Constructing Childhood in Social Interaction: How Parents Assert Epistemic Primacy over Their Children,” *Social Psychology Quarterly* 86 (1) (2023): 74–94, <https://doi.org/10.1177/01902725221130751>.

10Susan T. Fiske, Amy J. Cuddy, and Peter Glick, “Universal Dimensions of Social Cognition: Warmth and Competence,” *Trends in Cognitive Sciences* 11 (2) (2007): 77–83, <https://doi.org/10.1016/j.tics.2006.11.005>; and Ashley J. Thomas, “Cognitive Representations of Social Relationships and Their Developmental Origins,” *PsyArXiv* (2024), <https://doi.org/10.31234/osf.io/xhrfu>.

11Alan P. Fiske, “The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations,” *Psychological Review* 99 (4) (1992): 689–723, <https://doi.org/10.1037/0033-295X.99.4.689>; Lotte Thomsen and Susan Carey, “Core Cognition of Social Relations,” in *Navigating the Social World: What Infants, Children, and Other Species Can Teach Us*, eds. Mahzarin R. Banaji, and Susan A. Gelman (New York: Oxford University Press, 2013), 17-22, <https://doi.org/10.1093/acprof:oso/9780199890712.003.0004>; Lawrence A. Hirschfeld, “On a Folk Theory of Society: Children, Evolution, and Mental Representations of Social Groups,” *Personality and Social Psychology Review* 5 (2) (2001): 107–117, <https://doi.org/10.1207/S15327957PSPR0502_2>; Laurence Kaufmann and Fabrice Clément, “Wired for Society: Cognizing Pathways to Society and Culture,” *Topoi* 33 (2) (2014): 459–475, <https://doi.org/10.1007/s11245-014-9236-9>; and Ashley J. Thomas, “Cognitive Representations of Social Relationships and Their Developmental Origins,” *PsyArXiv* (2024), <https://doi.org/10.31234/osf.io/xhrfu>.

12Julian Jara-Ettinger, Hyowon Gweon, Laura E Schulz, and Joshua B Tenenbaum, “The Naïve Utility Calculus: Computational Principles Underlying Commonsense Psychology,” *Trends in Cognitive Sciences* 20 (10) (2016): 785–785, <https://doi.org/10.1016/j.tics.2016.08.007>; and Tomer D. Ullman and Joshua B. Tenenbaum, “Bayesian Models of Conceptual Development: Learning as Building Models of the World,” *Annual Review of Developmental Psychology* 2 (1) (2020): 533–558, <https://doi.org/10.1146/annurev-devpsych-121318-084833>.; and Powell, Lindsey J. "Adopted utility calculus: Origins of a concept of social affiliation." *Perspectives on Psychological Science* 17, no. 5 (2022): 1215-1233.

13Mark van Vugt and Joshua M. Tybur, “The Evolutionary Foundations of Status Hierarchy,” in *The Handbook of Evolutionary Psychology Second Edition Volume 2: Integrations,* ed. David Buss (Hoboken: John Wiley & Sons, Inc., 2015): 788-809, <https://doi.org/10.1002/9781119125563.evpsych232>; and Alan P. Fiske, “The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations,” *Psychological Review* 99 (4) (1992): 689–723, <https://doi.org/10.1037/0033-295X.99.4.689>.

14Jonathan F. Kominsky, Kelsey Lucca, Ashley J. Thomas, Michael C. Frank, and J. Kiley Hamlin, “Simplicity and Validity in Infant Research,” *Cognitive Development* 63 (2022): 101213, <https://doi.org/10.1016/j.cogdev.2022.101213>.

15Susan Carey, *The Origin of Concepts* (New York: Oxford University Press, 2009), <https://doi.org/10.1093/acprof:oso/9780195367638.001.0001>; and Elizabeth S. Spelke, *What Babies Know: Core Knowledge and Composition Volume 1* (New York: Oxford University Press, 2022), <https://doi.org/10.1093/oso/9780190618247.001.0001>.

16Amanda L. Woodward, “Infants Selectively Encode the Goal Object of an Actor’s Reach,” *Cognition* 69 (1) (1998): 1–34, <https://doi.org/10.1016/S0010-0277(98)00058-4>; Shari Liu, Neon B. Brooks, and Elizabeth S. Spelke, “Origins of the concepts cause, cost, and goal in prereaching infants,” *Proceedings of the National Academy of Sciences* 116 (36) (2019): 17747–17752, <https://doi.org/10.1073/pnas.1904410116>; Brandon M. Woo, Shari Liu, and Elizabeth S. Spelke, “Infants Rationally Infer the Goals of Other People’s Reaches in the Absence of First‐person Experience with Reaching Actions,” *Developmental Science* 27 (3) (2024): e13453, <https://doi.org/10.1111/desc.13453>; Jennifer S. Buresh and Amanda L. Woodward, “Infants Track Action Goals Within and Across Agents,” *Cognition* 104 (2) (2007): 287–314, <https://doi.org/10.1016/j.cognition.2006.07.001>; and Jessica A. Sommerville, Amanda L. Woodward, and Amy Needham, “Action Experience Alters 3-Month-Old Infants’ Perception of Others’ Actions,” *Cognition* 96 (1) (2005): B1–B11, <https://doi.org/10.1016/j.cognition.2004.07.004>.

17Gergely Csibra, “Goal Attribution to Inanimate Agents by 6.5-Month-Old Infants,” *Cognition* 107 (2) (2008): 705–717, <https://doi.org/10.1016/j.cognition.2007.08.001>.

18Jennifer S. Buresh and Amanda L. Woodward, “Infants Track Action Goals Within and Across Agents,” *Cognition* 104 (2) (2007): 287–314, <https://doi.org/10.1016/j.cognition.2006.07.001>.

19Rebecca R. Saxe, Susan Carey, and Nancy Kanwisher, “Understanding Other Minds: Linking Developmental Psychology and Functional Neuroimaging,” *Annual Review of Psychology* 55 (1) (2004): 87–124, <https://doi.org/10.1146/annurev.psych.55.090902.142044>.

20Amanda L. Woodward, “Infants Selectively Encode the Goal Object of an Actor's Reach,” *Cognition* 69 (1) (1998): 1–34, <https://doi.org/10.1016/S0010-0277(98)00058-4>.

21Zoe Liberman, Katherine D. Kinzler, and Amanda L. Woodward, “Origins of Homophily: Infants Expect People with Shared Preferences to Affiliate,” *Cognition* 212 (2021): 104695, <https://doi.org/10.1016/j.cognition.2021.104695>; and Lotte Thomsen, “The Developmental Origins of Social Hierarchy: How Infants and Young Children Mentally Represent and Respond to Power and Status,” *Current Opinion in Psychology* 33 (2020): 201–208, <https://doi.org/10.1016/j.copsyc.2019.07.044>.

22Christine Fawcett and Bahar Tunçgenç, “Infants’ Use of Movement Synchrony to Infer Social Affiliation in Others,” *Journal of Experimental Child Psychology* 160 (2017): 127–136, <https://doi.org/10.1016/j.jecp.2017.03.014>; and Lindsey J. Powell and Elizabeth S. Spelke, “Preverbal Infants Expect Members of Social Groups to Act Alike,” *Proceedings of the National Academy of Sciences* 110 (41) (2013): e3965–e3972, <https://doi.org/10.1073/pnas.1304326110>.

23Christine Fawcett and Bahar Tunçgenç, “Infants’ Use of Movement Synchrony to Infer Social Affiliation in Others,” *Journal of Experimental Child Psychology* 160 (2017): 127–136, <https://doi.org/10.1016/j.jecp.2017.03.014>; and Lindsey J. Powell and Elizabeth S. Spelke, “Preverbal Infants Expect Members of Social Groups to Act Alike,” *Proceedings of the National Academy of Sciences* 110 (41) (2013): e3965–e3972, <https://doi.org/10.1073/pnas.1304326110>.

24Bill Pepe and Lindsey J. Powell, “Infants’ Expectations for Prosociality in Imitators,” *OSF Preprints* (2023), <https://doi.org/10.31219/osf.io/cjnkb>

25Lindsey J. Powell and Elizabeth S. Spelke, “Preverbal Infants Expect Members of Social Groups to Act Alike,” *Proceedings of the National Academy of Sciences* 110 (41) (2013): e3965–e3972, <https://doi.org/10.1073/pnas.1304326110>; Vanessa Kudrnova, Elizabeth Spelke, and Ashley J. Thomas, “Infants Infer Social Relationships Between Individuals Who Engage in Imitative Social Interactions,” *PsyArXiv* (2023), <https://psyarxiv.com/zuwpc/download?format=pdf>; and Lindsey J. Powell and Elizabeth S. Spelke, “Human Infants’ Understanding of Social Imitation: Inferences of Affiliation from Third Party Observations,” *Cognition* 170 (2018): 31–48, <https://doi.org/10.1016/j.cognition.2017.09.007>.

26Andrew N. Meltzoff and M. Keith Moore, “Imitation, Memory, and the Representation of Persons,” *Infant Behavior and Development* 17 (1) (1994): 83–99, <https://doi.org/10.1016/0163-6383(94)90024-8>.

27Lotte Thomsen, Willem E Frankenhuis, McCaila Ingold-Smith, and Susan Carey, “Big and Mighty: Preverbal Infants Mentally Represent Social Dominance,” *Science* 331 (6016) (2011): 477–480, <https://doi.org/10.1126/science.1199198>; and Anthea Pun, Susan A. J. Birch, and Andrew S. Baron, “Foundations of Reasoning About Social Dominance,” *Child Development Perspectives* 11 (3) (2017): 155–160, <https://doi.org/10.1111/cdep.12235>.

28Lotte Thomsen and Susan Carey, “Core Cognition of Social Relations,” in *Navigating the Social World: What Infants, Children, and Other Species Can Teach Us*, eds. Mahzarin R. Banaji, and Susan A. Gelman (New York: Oxford University Press, 2013), 17-22, <https://doi.org/10.1093/acprof:oso/9780199890712.003.0004>; Denis Tatone, “The naïve sociology of resource transfer,” PhD diss, (Central European University, 2017); Ashley J. Thomas, “Cognitive Representations of Social Relationships and Their Developmental Origins,” *PsyArXiv* (2024), <https://doi.org/10.31234/osf.io/xhrfu>; Elizabeth S. Spelke, *What Babies Know: Core Knowledge and Composition Volume 1* (New York: Oxford University Press, 2022), <https://doi.org/10.1093/oso/9780190618247.001.0001>; Lindsey J. Powell and Elizabeth S. Spelke, “Preverbal Infants Expect Members of Social Groups to Act Alike,” *Proceedings of the National Academy of Sciences* 110 (41) (2013): E3965–E3972, <https://doi.org/10.1073/pnas.1304326110>; Lindsey J. Powell and Elizabeth S. Spelke, “Human Infants’ Understanding of Social Imitation: Inferences of Affiliation from Third Party Observations,” *Cognition* 170 (2018): 31–48, <https://doi.org/10.1016/j.cognition.2017.09.007>; Brandon M. Woo, Enda Tan, and J. Kiley Hamlin, “Human Morality Is Based on an Early-Emerging Moral Core,” *Annual Review of Developmental Psychology* 4 (1) (2022): 41–61, <https://doi.org/10.1146/annurev-devpsych-121020-023312>; Zoe Liberman, Katherine D. Kinzler, and Amanda L. Woodward, “The Early Social Significance of Shared Ritual Actions,” *Cognition* 171 (2018): 42–51, <https://doi.org/10.1016/j.cognition.2017.10.018>; Olivier Mascaro and Gergely Csibra, “Representation of Stable Social Dominance Relations by Human Infants,” *Proceedings of the National Academy of Sciences* 109 (18) (2012): 6862–6867, <https://doi.org/10.1073/pnas.1113194109>; Olivier Mascaro and Gergely Csibra, “Human Infants' Learning of Social Structures: The Case of Dominance Hierarchy,” *Psychological Science* 25 (1) (2014): 250–255, <https://doi.org/10.1177/0956797613500509>; Inderpreet K. Gill and Jessica A. Sommerville, “Generalizing Across Moral Sub-Domains: Infants Bidirectionally Link Fairness and Unfairness to Helping and Hindering,” *Frontiers in Psychology* 14 (2023): 1213409, <https://doi.org/10.3389/fpsyg.2023.1213409>; and Denis Tatone and Gergely Csibra, “Infants infer different types of social relations from giving and taking actions,” in *CogSci* (2020), <https://www.cognitivesciencesociety.org/cogsci20/papers/0748/0748.pdf>.

29Ashley J. Thomas, Brandon Woo, Daniel Nettle, Elizabeth Spelke, and Rebecca Saxe, “Early Concepts of Intimacy: Young Humans Use Saliva Sharing to Infer Close Relationships,” *Science (American Association for the Advancement of Science)* 375 (6578) (2022): 311–315, <https://doi.org/10.1126/science.abh1054>.

30Kyong-sun Jin, Jessica L. Houston, Renée Baillargeon, Ashley M. Groh, and Glenn I. Roisman, “Young Infants Expect an Unfamiliar Adult to Comfort a Crying Baby: Evidence from a Standard Violation-of-Expectation Task and a Novel Infant-Triggered-Video Task,” *Cognitive Psychology* 102 (2018): 1–20, <https://doi.org/10.1016/j.cogpsych.2017.12.004>.

31Susan C. Johnson, Carol S. Dweck, and Frances S. Chen, “Evidence for Infants' Internal Working Models of Attachment,” *Psychological Science* 18 (6) (2007): 501–502, <https://doi.org/10.1111/j.1467-9280.2007.01929.x>; Szilvia Biro, Lenneke R. A. Alink, Renske Huffmeijer, Marian J. Bakermans‐Kranenburg, and Marinus H. van IJzendoorn, “Attachment and Maternal Sensitivity Are Related to Infants’ Monitoring of Animated Social Interactions,” *Brain and Behavior* 5 (12) (2015): e00410, <https://doi.org/10.1002/brb3.410>; and Szilvia Biro, Mikko J. Peltola, Rens Huffmeijer, Lenneke R.A. Alink, Marian J. Bakermans-Kranenburg, and Marinus H. van IJzendoorn, “Frontal EEG Asymmetry in Infants Observing Separation and Comforting Events: The Role of Infants’ Attachment Relationship,” *Developmental Cognitive Neuroscience* 48 (2021): 100941, <https://doi.org/10.1016/j.dcn.2021.100941>.

32Ashley J. Thomas, Brandon Woo, Daniel Nettle, Elizabeth Spelke, and Rebecca Saxe, “Early Concepts of Intimacy: Young Humans Use Saliva Sharing to Infer Close Relationships,” *Science (American Association for the Advancement of Science)* 375 (6578) (2022): 311–315, <https://doi.org/10.1126/science.abh1054>.

33Christina M. Steele, Megan K. Richardson, Azwayla F. Taylor, Denis Tatone, and Ashley J. Thomas, “Early Threads of Connection: Probing Infants’ Early Understandings of Caregiving Relationships” in *CogSci* (in press).

34Agnieszka Sorokowska, Supreet Saluja, Piotr Sorokowski, Tomasz Frąckowiak, Maciej Karwowski, Toivo Aavik, Grace Akello, et al, “Affective Interpersonal Touch in Close Relationships: A Cross-Cultural Perspective,” *Personality & Social Psychology Bulletin* 47 (12) (2021): 1705–1721, <https://doi.org/10.1177/0146167220988373>; Juulia T. Suvilehto, Asta Cekaite, and India Morrison, “The Why, Who and How of Social Touch,” *Nature Reviews Psychology* 2 (10) (2023): 606–621, <https://doi.org/10.1038/s44159-023-00217-5>; Juulia T. Suvilehto, Enrico Glerean, Robin I. M. Dunbar, Riitta Hari, and Lauri Nummenmaa, “Topography of social touching depends on emotional bonds between humans,” *Proceedings of the National Academy of Sciences* 112 (45) (2015): 13811–13816, <https://doi.org/10.1073/pnas.1519231112>; Juulia T. Suvilehto, Lauri Nummenmaa, Tokiko Harada, Robin I. M. Dunbar, Riitta Hari, Robert Turner, Norihiro Sadato, and Ryo Kitada, “Cross-cultural similarity in relationship-specific social touching,” *Proceedings of the Royal Society B: Biological Sciences* 286 (1901) (2019): 20–20190467, <https://doi.org/10.1098/rspb.2019.0467>; and Lenora Duhn, “The Importance of Touch in the Development of Attachment,” *Advances in Neonatal Care* 10 (6) (2010): 294–300, <https://doi.org/10.1097/ANC.0b013e3181fd2263>.

35Christina M. Steele, Megan K. Richardson, Azwayla F. Taylor, Denis Tatone, and Ashley J. Thomas, “Early Threads of Connection: Probing Infants’ Early Understandings of Caregiving Relationships” in *CogSci* (in press).

36Annie C. Spokes and Elizabeth S. Spelke, “The Cradle of Social Knowledge: Infants’ Reasoning About Caregiving and Affiliation,” *Cognition* 159 (2017): 102–16, <https://doi.org/10.1016/j.cognition.2016.11.008>.

37Maria E. Barrera and Daphne Maurer, “Recognition of Mother's Photographed Face by the Three-Month-Old Infant,” *Child Development* 52 (2) (1981): 714–716, <https://doi.org/10.2307/1129196>; Olivier Pascalis, Scania de Schonen, John Morton, Christine Deruelle, and Marie Fabre-Grenet, “Mother's Face Recognition by Neonates: A Replication and an Extension,” *Infant Behavior and Development* 18 (1) (1995): 79–85, <https://doi.org/10.1016/0163-6383(95)90009-8>; Anthony J. DeCasper and William P. Fifer, “Of Human Bonding: Newborns Prefer Their Mothers' Voices,” *Science (American Association for the Advancement of Science)* 208 (4448) (1980): 1174–1176, <https://doi.org/10.1126/science.7375928>; Jacques Mehler, Josiane Bertoncini, Michele Barriere, and Dora Jassik-Gerschenfeld, “Infant Recognition of Mother's Voice,” *Perception* 7 (5) (1978): 491–497, <https://doi.org/10.1068/p070491>; Stefano Vaglio, “Chemical Communication and Mother-Infant Recognition,” *Communicative & Integrative Biology* 2 (3) (2009): 279–281, <https://doi.org/10.4161/cib.2.3.8227>; and Jennifer Campbell and D. Geoffrey Hall, “The Scope of Infants' Early Object Word Extensions,” *Cognition* 228 (2022): 105210–105210, <https://doi.org/10.1016/j.cognition.2022.105210>.

38Elizabeth Spelke, “Infants' Intermodal Perception of Events,” *Cognitive Psychology* 8 (4) (1976): 553–560, <https://doi.org/10.1016/0010-0285(76)90018-9>.

39Ashley J. Thomas, Brandon Woo, Daniel Nettle, Elizabeth Spelke, and Rebecca Saxe, “Early Concepts of Intimacy: Young Humans Use Saliva Sharing to Infer Close Relationships,” *Science (American Association for the Advancement of Science)* 375 (6578) (2022): 311–315, <https://doi.org/10.1126/science.abh1054>.

40Sarah B. Hrdy, *Mothers and Others: The Evolutionary Origins of Mutual Understanding* (Cambridge, Mass.: Harvard University Press, 2009), <https://doi.org/10.2307/j.ctt1c84czb>.

41Sarah B. Hrdy and Judith M. Burkart, “The Emergence of Emotionally Modern Humans: Implications for Language and Learning,” *Philosophical Transactions of the Royal Society of London. Series B. Biological Sciences* 375 (1803) (2020): 20190499–20190499, <https://doi.org/10.1098/rstb.2019.0499>.

42Susan C. Johnson, Carol S. Dweck, and Frances S. Chen, “Evidence for Infants' Internal Working Models of Attachment,” *Psychological Science* 18 (6) (2007): 501–502, <https://doi.org/10.1111/j.1467-9280.2007.01929.x>.

43Hugh C. Cutler and Martin Cardenas, “Chicha, A Native South American Beer,” *Botanical Museum Leaflets, Harvard University* 13 (3) (1947): 33–60, <https://doi.org/10.5962/p.295173>; and Justin Jennings and Brenda J. Bowser*, Drink, Power, and Society in the Andes* (Gainesville: University Press of Florida, 2009) <https://muse.jhu.edu/book/17479>.

44Susan C. Johnson, Carol S. Dweck, and Frances S. Chen, “Evidence for Infants' Internal Working Models of Attachment,” *Psychological Science* 18 (6) (2007): 501–502, <https://doi.org/10.1111/j.1467-9280.2007.01929.x>; Szilvia Biro, Lenneke R. A. Alink, Renske Huffmeijer, Marian J. Bakermans‐Kranenburg, and Marinus H. van IJzendoorn, “Attachment and Maternal Sensitivity Are Related to Infants’ Monitoring of Animated Social Interactions,” *Brain and Behavior* 5 (12) (2015): e00410, <https://doi.org/10.1002/brb3.410>; and Szilvia Biro, Mikko J. Peltola, Rens Huffmeijer, Lenneke R.A. Alink, Marian J. Bakermans-Kranenburg, and Marinus H. van IJzendoorn, “Frontal EEG Asymmetry in Infants Observing Separation and Comforting Events: The Role of Infants’ Attachment Relationship,” *Developmental Cognitive Neuroscience* 48 (2021): 100941, <https://doi.org/10.1016/j.dcn.2021.100941>.

45Susan Carey, *Conceptual Change in Childhood* (Cambridge, Mass.: MIT Press, 1985); andStella Vosniadou and William F Brewer, “Mental Models of the Earth: A Study of Conceptual Change in Childhood,” *Cognitive Psychology* 24 (4) (1992): 535–585, <https://doi.org/10.1016/0010-0285(92)90018-W>.

46Lizette Pizza and Deborah Kelemen, “Are Humans Part of the Natural World? U.S. Children's and Adults’ Concept of Nature and Its Relationship to Environmental Concern,” *Topics in Cognitive Science* 15 (3) (2023): 452–479, <https://doi.org/10.1111/tops.12675>.

47Joan C. Tronto, “An Ethic of Care,” *Generations: Journal of the American Society on Aging* 22 (3) (1998): 15–20; Brittani R. Orona, “Save California Salmon and the Fight for Water Through Indigenous Ethics in Northwestern California,” in *From the Skin: Defending Indigenous Nations Using Theory and Praxis*, eds. Jerome J. Clark and Elise Boxer (University of Arizona Press, 2023), 31; Kim TallBear, “Caretaking Relations, Not American Dreaming,” *Kalfou: A Journal of Comparative and Relational Ethnic Studies* 6 (1) (2019): 24–41, <https://doi.org/10.15367/kf.v6i1.228>; Lizette Pizza and Deborah Kelemen, “Are Humans Part of the Natural World? U.S. Children's and Adults’ Concept of Nature and Its Relationship to Environmental Concern,” *Topics in Cognitive Science* 15 (3) (2023): 452–479, <https://doi.org/10.1111/tops.12675>; Lizette Pizza and Roberto Posada, “"You Have the River to Throw It Away": Colombian Children's Reasoning About Transgressions to Nature in Contexts of Economic Performance and Communitarian Needs,” *Ecopsychology* 12 (4) (2020): 267–276, <https://doi.org/10.1089/eco.2019.0061>; and Lizette Y. P. Becerra, "El rol de los supuestos informacionales antropocéntricos en las evaluaciones morales sobre las transgresiones al ambiente natural," PhD diss, (Universidad Nacional de Colombia, 2017).