How Do Infants Experience Caregiving?

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Almost all of human infants' experience and learning takes place in the context of caregiving relationships. This essay considers how infants understand the care they receive. We begin by outlining plausible features of an "intuitive theory" of care. In 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 how adults think about caregiving. In particular, infants understand care relationships as intimate, altruistic, and asymmetric. We review work that starts to shed light on this proposal, including the findings that infants distinguish between intimate relationships and merely positive ones and that they have asymmetric expectations of responses to distress in intimate relationships 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.

W e are alive today because we received a tremendous amount of care when we were young. Human infants couldn't survive otherwise. Compared with other species, we are born especially dependent on our caregivers, and our infancy is especially long.[1] 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 (such as hunger, discomfort, fear, sleepiness). Over time, she may learn to predict that some of her actions (like screaming) and sensory experiences (such as 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 (such as "mom" or "me"), causes ("mom responds because she cares"),

or relationships ("mom is connected to me"). She would simply understand that when she reacts to these aversive states with certain actions (like crying), it predicts that other things will follow (for example, 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 their physical attributes, including their larger size. Moreover, the relationship is altruistic: an adult observer would expect the larger creature to use their 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 infants' 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. But must infants 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 essay, we argue the opposite: before infants can reliably use language and before they 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.[2] 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 (such as parents, grandparents, older siblings, close friends) and those who do not (such as younger siblings). It would also support learning about who among their caregivers are family and who are not (daycare teachers, nannies, and so on).

What would an adult intuitive theory of caregiving look like? What evidence is there that supports the proposal that our adult intuitive theory is built on infant intuitions about caregiving relationships? And finally, what are some of the intellectual, societal, and political implications of this proposal?

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 under-

standings of varied situations.[4] These theories do not require formal education but instead are the "everyday" ways 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 (for example, 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 six months old, and they 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 (one that is mutually beneficial). 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 through which individuals pool resources and capabilities to achieve collective goals.

We propose that caregiving relationships have a distinctive intuitive 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 are matched by similarly valued gifts over time. A friend who never takes a turn preparing a meal, or suggesting an activity, or sharing a confidence will 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 asym-

metry makes caregiving similar to dominance relationships, in which individuals differ in power and control of resources.[9] But 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, adult 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 cared-for person either cannot achieve their goals and fulfill their interests for themself or does not know what is best for them.[10]

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 those goals are in the cared-for person's 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 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 in close biological or legal relationships. In times of need like infancy, old age, and ill health, it is most often parents, siblings, adult children, and spouses who engage in sustained caregiving. Nevertheless, caregiving can extend far beyond biological kinship. And in acts analogous to physical caregiving, people provide mental or emotional support to 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 (for instance, that they are generous or competitive), adults organize their observations of the social world in terms of unobserved but causally central concepts of relationships.[11] Using these latent concepts as hypotheses, adults can fluently recognize distinct types of relationships from limited observa-

tions, infer features of those relationships that go well beyond those observations, and form predictions for the participants' future behaviors in new situations.[12]

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 about the beliefs and desires that explain others' goal-directed actions.[13] 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 and affiliation? An advantage of computational models is that they require scientists to make their hypotheses, and their alternatives, fully explicit. Efforts toward such a formal model are underway.

The key question for this essay, however, concerns the developmental origins of these adult intuitions. What evidence is there that the adult intuitive theory of caregiving has its origins in infancy?

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' nonverbal behavior: what they look at or the way they act. Researchers measure where and how long infants look at events, scenes, objects, or individuals (including people, animated characters, puppets).[14] These methods reveal systematic patterns both in how long infants look at events (for example, infants look reliably longer at physically impossible scenes than at probable ones), 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 (that an unsupported object will fall), discriminate quantities (for example, infants can distinguish between 1 and 3), and recognize "agents" (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 someone reaching for an object 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 on a stage: for example, an infant might see a person reach for a ball on the right while rejecting a toy bear on the left (refer to Figure 1).[16] This whole sequence repeats six to fourteen times until the infant begins to lose interest. Next, after obscuring the objects, 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, and more important which object they grasp. That is, adults see a person who wants a ball, not a bear. By five 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 familiar with the person, or objects, to make these inferences: the experiments show infants an unfamiliar stranger reaching for a particular 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 eight-month-old infants cannot jump at all, let alone leap over a barrier the size of a semitruck, 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; if a new person reaches for the bear, infants are not surprised.[18] Further, in-

Figure 1
Infant Expectations about Reaching Behavior
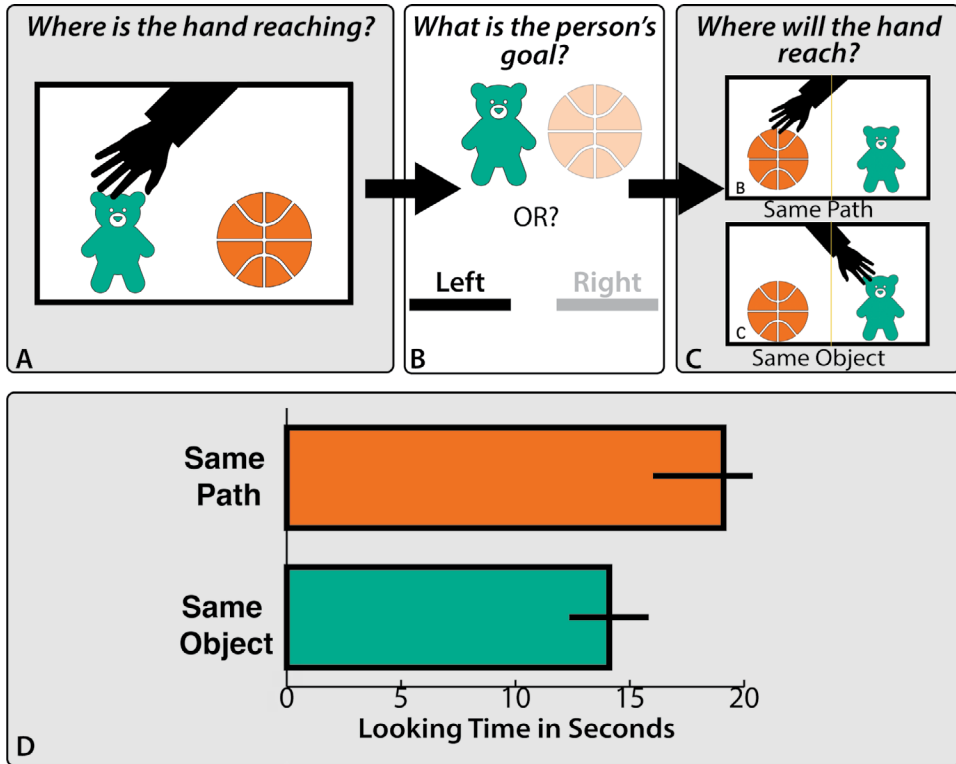
Schematic of stimuli used in the classic infant studies described above: A) First infants see the familiarization events, in which a hand repeatedly reaches for an object. Across these events, the object appears in the same location, so the hand takes the same path. B) Starting at five months, infants interpret the reaching as object-directed. Earlier, they are open-minded about whether the goal is the location or the 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. Source: Example dataset recreated using means and standard deviations reported in Amanda L. Woodward, "Infants Selectively Encode the Goal Object of an Actor's Reach," *Cognition* 69 (1) (1998): 1–34. Figure by the authors.

fants 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 the person's goals are stable. More generally, infants clearly distinguish between events caused by people

or goal-directed agents and 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]

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.[20] 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.[21] Infants also infer that groups of three characters go together if they make movements that look like a synchronized "dance."[22]

Infants also have specific expectations about how individuals 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, eight- and nine-month-old infants observe three animated characters: a red sphere, a yellow cone, and a blue cylinder.[23] In the first scene, the red character looks toward the yellow cone and jumps up and down. The yellow cone imitates the red character by jumping up and down. Next, the red character looks toward the blue cylinder and makes the same movement. This time, the blue cylinder makes a different movement in response and spins around. Infants see these scenes repeated six times, played on a loop until they lose interest. Afterward, infants watch the red character move through a narrow pathway that is 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, helps the red character by pushing the barrier out of the way. The eight- to nine-month-old infants seem to expect the imitator (yellow cone) to help: they look longer at the scene where the non-imitator (blue cylinder) cleared the path than at the scene where the imitator did. These results agree with many other studies in which infants expect positive social interactions after they observe imitation.[24] 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.[25] 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 when their goals conflict. They make similar inferences in other contexts, expecting agents with more allies to prevail and agents who have won in the past to do so again.[26] 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.[27] For adults, such actions seem to be a strong indication of particularly close relationships. Those interactions are also especially likely to take place between infants and their caregivers.

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] But what are the implications of these studies for the question of whether and how infants understand caregiving?

It is unlikely that an infant's experience of caregiving is only sensory. Based on the studies we have described above, 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 involving touch or 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 they do not establish that infants do so in the way we propose. Specifically, 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 relationships from other 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. Third, 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. We build off our prior work showing that infants treat touch and saliva-sharing as signs of intimacy.[29] We also build off prior work showing that infants expect others to provide comfort in particular 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 cried 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 animated big and small ovals. 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 two sets of studies, we have also investigated under which conditions infants expect comforting to occur. In the first set, we asked whether infants expected specific individuals to provide comfort based on cues of social intimacy.[32] Infants, aged eight to ten 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. In preliminary findings, infants have 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. These studies suggest that infants recognize intimate social relationships.

In the second set of studies, we investigated whether infants recognize that caregiving is an asymmetric relationship in which one agent has more power or 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. In these studies, we depicted intimacy with social touch.[34] We showed infants a small character who had the same interaction with both a larger and similarly small character (see Figure 2). In the intimate scene, a small yellow character touches and dances with a large blue character and a small green character. Which character would infants expect to respond to the yellow character's distress? We found that infants looked first and longer at the large character, suggesting they anticipated that the large character would respond. Next, we showed infants the same scenes, but this time the characters danced without touching. The result was that infants no longer expected the large character to respond.

This finding suggests that within intimate relationships, infants expect comforting behavior between large and small characters. For infants, physical size also predicts a person's role in a caregiving relationship: the more capable (that is, larger) person will provide care for the less capable (smaller) individual, but not usually 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 this time 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 charac-

Figure 2
Infant Understanding of Caregiving via Touch and their Expectations of Responses to Distress
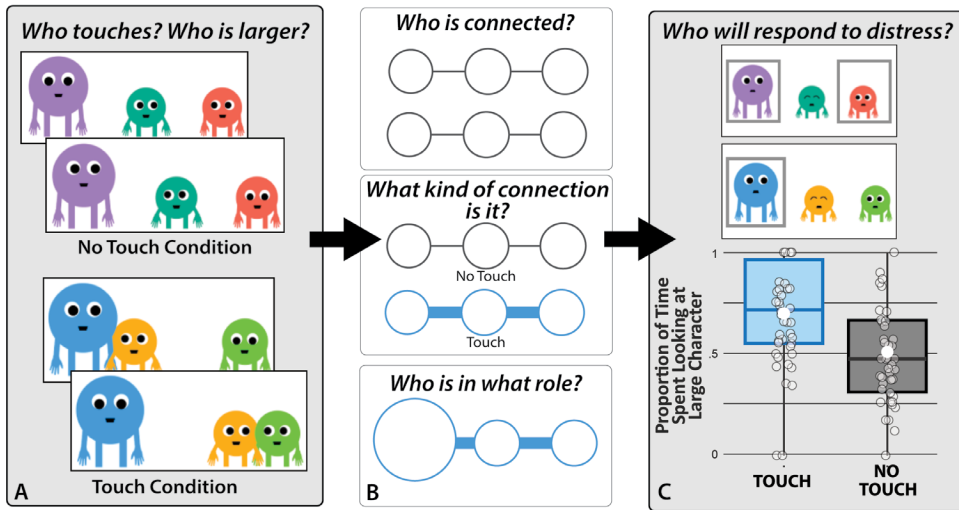
In the experiment, infants see animated scenes in which the central character either "dances" with and touches the two outer characters or dances with but does not touch the outer characters. We hypothesize that infants use these interactions to make inferences about who is connected and whether the connection is intimate (in the touching interaction) or positive but not intimate (in the no-touch interaction). We further hypothesize that infants then use size to understand who is in what role. Source : For data and further context, see Christina M. Steele, Megan K. Richardson, Azwayla F. Taylor, et al., "Early Threads of Connection : Probing Infants' Early Understandings of Caregiving Relationships," *Proceedings of the Annual Meeting of the Cognitive Science Society* 46 (2024). Figure by the authors.

ter's distress. This suggests infants don't have consistent expectations about who will respond to a large character's distress.[35]

An important feature of the intuitive theory we propose is that it applies both to the infant's 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 fifteen-month-old infants used triadic closure to make sense of social interactions. For example, infants expect two large characters to go together if they respond to the same small crying 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 and 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 (see Figure 3).[38] After they were shown this scene six times, they saw a test trial that took advantage of the infants' ability to match visual and audio stimuli.[39] 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 determine 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, looking off-screen and calling 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 featuring 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.

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 learn and remember: 1) who shares saliva with, touches, and holds and comforts the infant; 2) who else these caregivers share saliva with, touch, and hold and comfort; and 3) who shares saliva with, touches, and holds and comforts 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 not often physically present. 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

Figure 3
Infant Perception and Interpretation of Parents' Social Interactions
with New Individuals
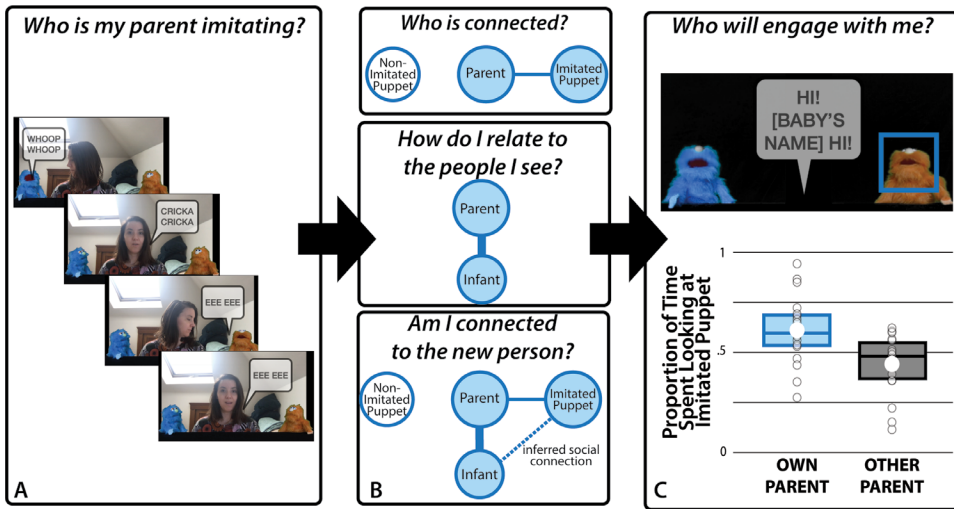
A) Infants see videos of their parents interacting with puppets. In the scene, the puppets vocalized distinct nonsense syllables (for instance, "eee eee" or "whoop whoop"). Then, the parent imitates one of the puppets but not the other. B) We propose that infants parse this scene by inferring who is 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 both puppets move their mouths but only one voice calls to the infant. (bottom) Graph showing data from one study: larger white dots are means, lines are medians, and gray-outline dots are individual babies' data. Infants spent more time looking at the puppet who was imitated only after seeing their own parent interacting with the puppets. Source: For data and more context, see Ashley J. Thomas, Rebecca Saxe, and Elizabeth S. Spelke, "Infants Infer Potential Social Partners by Observing the Interactions of Their Parent with Unknown Others," *Proceedings of the National Academy of Sciences* 119 (32) (2022): e2121390119. Figure by the authors.

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).[40] If infants discriminate between intimate and nonintimate caregivers, this distinction could help infants accept the temporary and transient presence of paid caregivers. These are speculations that 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.[41] Thus, infants may be especially sensitive to potential alloparents, and actively behave in ways that recruit care.[42] Innate elements of an intuitive theory of caregiving then might be especially evolutionarily adaptive for human infants.

Alternatively, or in addition, infants' ecological niche means that experiences of caregiving are frequent and pervasive, indeed, 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 infants' 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 did infants with insecure attachments.[43]

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 U.S.-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 as inputs 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.[44] Such environmental variation leaves open questions about how variable infants' expectations may be, 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," which are like intuitive theories, in attachment theory. 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 personal caregivers. At least one set of studies suggests that this

may be true : 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.[45] 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 counterevidence can eventually lead to theory revision.

These findings also raise 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 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.[46] Are there ways that early intuitions about caregiving might interfere with, 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?

One 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 them ; and we can conceive of care as involving abstract institutions and groups.[47] 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.

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 involve land, other species, deceased people, or even future generations.[48] We propose that understanding caregiving relationships in terms of an intuitive theory that specifies that care is intimate, altruistic, and asymmetric may shape how people conceive of at least part of the interconnected world into which we are born.

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