

ZERO TO THREE JOURNAL

Creating Bright Futures for Babies and Toddlers: ZERO TO THREE's Annual Conference 2017

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This issue features presenters from ZERO TO THREE's Annual Conference, held November 28 to December 2, 2017, in San Diego, CA, where ZERO TO THREE and more than 3,500 attendees celebrated the organization's 40th anniversary! Founded in 1977 with one employee, the organization was launched as the National Center for Clinical Infant Programs by internationally renowned leaders in the fields of medicine, mental health, social science research, child development, and community leadership, to advance the healthy development of infants, toddlers, and their families. Today, ZERO TO THREE has grown to more than 160 employees, and more than 3,000 members, representing 28 countries and all 50 states, Puerto Rico, and the Virgin Islands! One of the highlights of the Annual Conference was the opportunity to meet and network with more than 800 ZERO TO THREE members. One of our members shared about her experience of the Annual Conference: *"The most beneficial things for me were the Member's Only sessions (including the televised Keynotes)...I love the small group atmosphere and questions-and-answer sessions. Plus, you get to network with some of the most amazing people in the ZERO TO THREE community."* To learn more about membership, visit <https://www.zerotothree.org/membership>.

The articles in this issue of the *ZERO TO THREE Journal* distill some of the valuable learning from leading experts, covering the topics of brain development, early language learning, the impact of immigration enforcement policies, engaging staff members in reflective supervision, issues in child welfare, and infant and early childhood mental health interventions. If you want to see and hear more from the conference, ZERO TO THREE is offering a new Conference Library subscription service, available at <https://www.zerotothree.org/resources/2110-conference-library>. Subscriptions and access to recordings will begin in March 2018.

Please note that the 2018 Annual Conference is "moving" to a new month. We hope to see you this October 3–5 in Denver, Colorado. For more information, visit <http://annualconference.zerotothree.org>. The Call for Proposals is now open until February 13, 2018.

Stefanie Powers, Editor
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How Babies Think

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Abstract

Babies think differently than adults, and understanding how they think can help us see their explosive brain growth in everyday behavior. Infants learn language faster than adults do, use statistics to understand how the world works, and even reason about the minds of others. But these achievements can be hidden by their poor self-regulatory skills, their distractibility (because of their interest in what is new and different), and their in-the-moment mental focus (making transitions difficult). Recognizing how infants try to understand the world can help reveal how perfectly suited they are to adapting to and thriving in a complex world.

It's morning, and the children are bright and cheerful. In the infant room, little Esteban crawls toward another baby who is exploring a shape sorter. Esteban watches the other child intently and then reaches for a block in the other child's hand. The child begins to whimper. Esteban freezes. Then, slowly, his chin also begins to quiver and his eyes fill with tears. As a teacher calms the child, Esteban takes the child's block and then another and bangs them both against the top of the shape sorter. A moment later, he is heading off in another direction.

Our work with infants and toddlers sometimes feels a bit like cultural anthropology. We're trying to figure out the thinking of little people who seem to approach the world in ways that are similar to but different from ours. Their reasoning can be as perplexing as it is fascinating. What is a baby thinking when he or she encounters another baby or explores a shape sorter? Added to our interest is the research that shows how their brains are growing at an explosive rate—but that is sometimes difficult to see played out in Esteban's behavior. How do babies think? How does their thinking reveal the brain's rapid development?

It is certainly true that babies think differently than adults do, in ways that reflect both the astonishing growth of their brains and their thirst for understanding. But many of their mental achievements are well-disguised and require an adult's sensitive awareness of how babies reason. Here we outline some of these hidden achievements and the logic of babies. But first, let's start with the brain.

Brain Development

Babies wear many hats, and not just the knit caps we try so desperately to wrestle onto their heads before going outside on a chilly day. Babies are linguistic geniuses, logic savants, philosophical sophisticates—and that's just between naptime and their next meal. But we will get to that in a moment.

Between the sleeping, eating, and yes, the meltdowns, babies are making sense of their world at an astonishing pace. During the first few years of life, babies' brains work in a way that they never will again. Their capacity to learn from almost every experience is so incredible that it can be hard to relate to and, sometimes, easy to forget.

Behind their big, bright eyes is a powerful brain, growing larger every day. In the first year of their life, their brain will swell from 25% of its adult size to more than 70% of its adult size (Mancall & Brock, 2010). No other part of the body grows nearly that fast. For comparison, imagine for a moment working in a room of 4-foot-tall 1-year-olds! As a baby's brain is growing in size, neurons are building networks across their brains and throughout their bodies. Just like any other cell in the body, neurons have a specialized job to do. They are the bodies' communication team. They connect, they integrate, they synthesize, and they deliver a targeted message. And just like the communications team of a newly formed organization, babies' brains haven't made all the connections yet. This is a really good thing. When the brain learns something, new connections (*synapses*) form between the cells, or the strength of those connections change. The ability to alter the microcircuitry of

the brain throughout life is what gives humans the incredible ability to learn. But this ability to mold the brain, called *neuroplasticity*, isn't constant throughout life.

With so much to learn, babies are forming synaptic connections at an incredible rate. Though it is nearly impossible to measure directly, scientists estimate that a baby's brain makes more than a million new neural connections each second (Center on the Developing Child, 2009). In fact, babies learn so much so quickly that their brains form too many connections. A 2-year-old has two times the neural connections of an adult (Huttenlocher, 1979). But having all those connections isn't efficient, and over the course of childhood, brains remove connections that aren't used very often. Although this might seem like an unpleasant fact of development, it is anything but. *Pruning*, or removing the unnecessary connections in our brains, allows a person to specialize her brain, to tailor it better than a favorite pair of jeans, to reflect exactly who she is and what she can do. Through the process of pruning, humans become experts at living their unique lives in the environments in which they're living.

In early childhood, and again in the teens, brains go through bursts of refinement, forming and then optimizing the connections in the brain. Connections determine who a person is, what he does, and how he does it. Early childhood provides an incredible window of opportunity. With neural connections forming and being refined at such an incredible rate, there isn't a certain time when babies are learning—they are always learning. Every moment, each experience translates into physical trace, a part of the brain's growing network.

Hidden Achievements

Even though the brain is growing at an incredible rate, it can sometimes be hard to map that growth onto the primary activities of newborns: sleeping and eating. But as they sleep and eat, and during phases when they are quiet or actively alert, infants are making remarkable achievements.

Language

Think for a moment about someone who is just really good with language. You know the type. Your favorite novelist, a lyrical artist you can't get enough of, that one co-worker who *always* seems to know just what to say in meetings, even the witty social media post you can't wait to share, all of these people are skilled with language. But they're probably not as good as a newborn baby.

Infants soak up sounds, master complex grammar, and absorb new words at an amazing pace. Even before they are born, infants are learning language. At birth, infants are already able to tell the difference between the language(s) that their mother speaks and sounds from a foreign language (Moon, Lagercrantz, & Kuhl, 2013). But this doesn't mean that they are set in their ways. Six-month-old infants can tell the difference between all of the different sounds that exist in the thousands of languages spoken around the globe. They are citizens of



Photo: Uber Images/shutterstock

As a baby's brain is growing in size, neurons are building networks across their brains and throughout their bodies.

the world. And that makes sense, because a newborn cannot know she has been born in Mexico City, or New York, or Hanoi, so her brain must be prepared to learn Spanish, English, Vietnamese, or any other language around the world. All those connections the brain has been making in the early months prepare her to do so.

Adults are *culture-bound listeners*; who know only the sounds that are common to their own languages. And this gradually becomes true of babies as their brains rewire to become specialists in the language(s) they are learning. Babies quickly learn what sounds matter and what sounds don't based on their experience. By 11 months old, babies have evolved into culture-bound listeners like adults. By this time they are experts at making out the sounds in the languages that they know, while simultaneously losing the ability to distinguish between sounds that don't occur in their home languages (Kuhl et al., 2006).

This means that even before babies utter their first word, their brains are hard at work as they listen to language. It is as if their brains are rehearsing, trying to figure out how to make the complex sounds they are hearing into words of their own (Imada et al., 2006; Kuhl, Ramirez, Bosseler, Lin, & Imada, 2014). This is why it is so important to talk to babies even before they say their first word.

During this early period in language development, children can easily learn more than one language, and researchers can see evidence of this in the brain. By the time babies are 11 months old, researchers can already see brain activity indicating that the brain is specializing in the languages that the baby is learning. For example, babies who are learning Spanish and English are creating brains that specialize in both languages (Ferjan Ramirez, Ramirez, Clarke, Taulu, & Kuhl, 2017). What's more, when scientists look at the brains of bilingual babies, they see increased activity in the prefrontal region of the brain



Every moment, each experience translates into physical trace, a part of the brain's growing network.

(Ferjan Ramirez et al., 2017). The prefrontal cortex helps with focus and flexible thinking. Children who are learning two or more languages practice these skills as they learn multiple sets of language rules and actively switch between them throughout the day. This research suggests that not only does learning multiple languages provide invaluable benefits to children's developing identity, but that these benefits extend to cognitive skills that, taken together, can later translate into improved academic outcomes (Blair & Razza, 2007; Carlson & Meltzoff, 2008).

Causal Reasoning

Babies are also building complex logic and reasoning skills. In fact, in many ways, babies and scientists share the same job. They both are trying to figure out how this great big world they live in works. To make sense of it all, babies use their incredible logic skills to sort it out. In an experimental context, babies as young as 8 months old notice when an unlikely event happens (Xu & Garcia, 2008). At 11 months, infants change their pattern of exploration to match a given set of evidence. For example, researchers showed infants some mysterious cars; some seemed to defy gravity, and others appeared to zip through a solid wall. When given the chance to play with the cars, babies tended to drop the cars that appeared to challenge the rule of gravity and to bang the cars that seemed to defy solidity (Stahl & Feigenson, 2015). These babies were systematically testing the unlikely actions that each car seemed to be capable of.

Knowing when something is likely or unlikely, and exploring things that seem to have surprising qualities, helps infants sort through what is important and meaningful in their world. Even when young children are presented with messy evidence, they are able to keep track of data and make an informed decision about what might work best—just like a scientist! Two-year-old toddlers, for example, are able to watch a researcher use

two different strategies to make a toy work. Neither strategy worked all the time, but one worked better than the other. After watching 12 attempts, toddlers are able to keep track of all that messy data and pick the strategy that is statistically most likely to work (Waismeyer, Meltzoff, & Gopnik, 2015).

Toddlers learn how to make something happen in the world just by watching. Considering that every day infants are faced with new objects, new rules, and new social puzzles to figure out, it makes sense that they would have to be skilled in this sort of logical reasoning. And it isn't just gravity and toy mechanisms that babies are trying to figure out. They are trying to figure out how adults work, too. Babies are carefully analyzing adults' behavior and identifying regular patterns (*when I smile, Daddy smiles back*). Infants' ability to make predictions based on the patterns of adults' behavior is one of the reasons that consistent, contingent, and responsive care is so essential to a child's healthy development and learning. In their interaction with adults, babies are eager to figure out what adults are doing, why adults are doing it, and how they can do it too (Meltzoff & Kuhl, 2016).

Learning About People

Why do babies so desperately want to answer these questions? Because to a baby, *you* are the most interesting thing in the world. From before they are born, infants are tuned in to events that are human: the sound of human voices and people's faces and actions. And babies know one thing very well: people are different than objects. For one thing, people respond to the baby's behavior: a baby can smile all she likes at the teddy bear and it won't do anything, but if she smiles at dad, he makes the most amazing sounds and expressions. The experience of having something or, more important, someone responding to her actions is one of the most enjoyable events in the life of a baby who doesn't feel much control over anything else in the world.

Just as they do with objects, babies also carefully watch people to see what is meaningful and what things go together. They quickly learn the significance of people's emotional expressions—hesitating when they hear an angry voice, for example, but playing at ease when the voice is pleasant (Fernald, 1993). They learn that what people are looking at affects what they do (e.g., Grandma looks at the cabinet door before opening it). This is one reason that infants begin pointing at things—such as the banana they want or the interesting bird outside—because getting someone to think about what you're thinking about means that they have to be looking at it too (Tomasello, Carpenter, & Lizkowski, 2007).

If this sounds like babies are trying to read your mind (and influence it), that's correct. More precisely, researchers believe that babies are developing a "theory of mind" to understand the mental states that motivate what people do (Wellman, 2014). Essentially babies are learning that you have feelings and intentions that affect your behavior and that those might be different than what they want and feel. Emotions and perceptions (what people are looking at) are early ingredients of this theory. So

are intentions and goals. Shortly after their first birthday, babies begin interpreting people's actions in terms of the goals they might be accomplishing—opening the cabinet door to get a glass, for example (Meltzoff, 1995; Woodward, 2009). Maybe because they have become such intentional, goal-directed dynamos in their own activity, babies begin perceiving that others' actions are motivated in the same way. From there, it is a short step to appreciate that people are also motivated by desires—Grandma wanted a drink of water.

Infants are taking their first baby steps toward a rich understanding of the mental states that exist in other people and in themselves, a journey that will last several years. Even at this early stage, though, two things are clear. First, infants really aren't egocentric creatures. They appreciate that people have different mental states and that those feelings and perceptions are different from their own. In fact, the reason they want to try to understand what another is feeling or thinking is precisely because they realize that it is *different* from their own feelings and thoughts. And understanding these differences might explain why someone is acting in a particular way.

Second, what babies learn about the mind has practical value. Consider, for example, a 1-year-old who encounters a friendly stranger at the supermarket. Should the baby be fearful or friendly? Who knows? Perhaps Mommy does. In this situation, most infants will turn to look at their mother's emotional expression. If she looks relaxed and friendly, the baby will likely be sociable toward the stranger; if she looks anxious and afraid, the baby will be also. (If mom isn't looking at the stranger at all, the baby will try to draw her attention with grunts and gestures. Babies know that they can't tell what mom feels about this stranger unless she is looking at him.) Using an adult's affective displays to regulate their own response is called *social referencing*. It is one of many practical ways that knowledge of the mind helps babies in their everyday learning about the social world (Klinnert, Emde, Butterfield, & Campos, 1986).

Hidden Questions

Adults are so accustomed to nurturing and caring for babies that it is easy to forget that babies are designed primarily for one thing: survival. They have to be, because they are helpless and depend on others. For this reason, many researchers believe that some implicit questions guide how babies respond to the environment in the early months after birth.

First: *is the world safe or dangerous?* In a safe world, babies can explore and discover in security, while a dangerous world requires vigilance to threat and danger. One way of determining whether the world is safe or dangerous is this: how much stress am I experiencing? There is evidence that even before birth, the fetus is sensitive to stress hormones from the mother's body and its development is altered by them. Chronic maternal stress can lead to increased reactivity and poorer self-regulation (Davis & Thompson, 2014). Researchers have found similar effects when a baby directly experiences stress after birth; as a result, infants becoming more sensitive



Photo: Kim Ruoff/shutterstock

Infants soak up sounds, master complex grammar, and absorb new words at an amazing pace.

and reactive to stress (Thompson, 2014). These findings help researchers understand why babies are so sensitive to signs of difficulty in the world around them, such as the sights and sounds of conflict in the home, or interacting with a depressed or anxious caregiver, or chaos and unpredictability at home or in a child care setting.

Second, *who has my back?* Every world has stressors, but to be able to cope you have to know who you can count on for support. This is especially true for infants. They don't have many ways to cope on their own yet. Babies need to figure out who are reliable sources of support. And they do that by quickly learning who responds to their needs. This is why the sensitivity and supportive responsiveness of parents and other care providers are so important.

There are other important implicit questions guiding early development: Is this an environment where there is enough food? How do I interact and communicate with those around me? One reason the brain and the mind grow so quickly in the first year is to help babies figure these questions out. Keeping these essential questions in mind can be helpful when caring

Learn More

Books

The Scientist in the Crib
A. Gopnik, A. N. Meltzoff, & P. K. Kuhl (2000)
New York, NY: HarperCollins

The Emotional Life of the Toddler
A. Lieberman (1995)
New York, NY: Free Press

Websites

Institute for Learning & Brain Sciences Online Training Modules
<http://modules.ilabs.uw.edu>

Harvard University, Center on the Developing Child
<https://developingchild.harvard.edu>



The infant mind is oriented toward what is new and different, and that's why infants learn so quickly from the world.

for infants. The world, as adults see it, is not the same world babies see. For the baby, safety and security are central.

So Why Don't Babies Act Like Einstein?

We've been spending a great deal of time describing the way babies think and the incredible genius of babies' minds. But ask any caregiver and the answer is clear—this baby is no Einstein. She spends a lot of time asleep, and when awake she can be unpredictable, distractible, fussy, and at times clueless. What gives?

It can help to appreciate that the characteristics of infant behavior that are so incongruous are often reflections of the rapid development of the brain and mind. The infant mind is oriented toward what is new and different, and that's why infants learn so quickly from the world. But it also makes them distractible. Furthermore, unlike adults, who tend to hold many things in their mind at once (think mental multitasking), babies' thinking is remarkably focused and in-the-moment. This intense, in-the-moment mode led one psychologist to describe babies as "more conscious" than adults (Gopnik, 2009). But their mental focus can cause them to fall apart during transitions (diaper change) or prohibitions (no hands in the kitty litter). And, of course, all this mental work is tiring—which is why babies are so often fussy and need their naps.

Einstein and babies have at least one thing in common: they both are capable of intense focus. But they also have at least one important difference: self-regulation. Self-regulation is what allows adults to manage emotions, focus attention, inhibit impulses, concentrate, and exercise mental flexibility. All of

these skills allow adults to manage themselves in ways that are beyond the capabilities of infants and young children. This is because the development of self-regulation is based in areas of the prefrontal cortex that are among the slowest to mature. The prefrontal cortex begins to mature in infancy; it develops and is refined throughout adolescence and even into young adulthood. This means that infants have taken only the first steps in the development of self-regulation (which is important for parents to know). Children's limited capacity to self-regulate also means that they have a limited ability to regulate their emotions. Asking toddlers to control their emotions or impulses is not something they can do. At this age, children haven't yet established those neural networks, and this type of self-regulation is not biologically possible. Babies don't act like Einstein because of the limitations in their self-regulation, even though remarkable mental accomplishments are occurring underneath the surface.

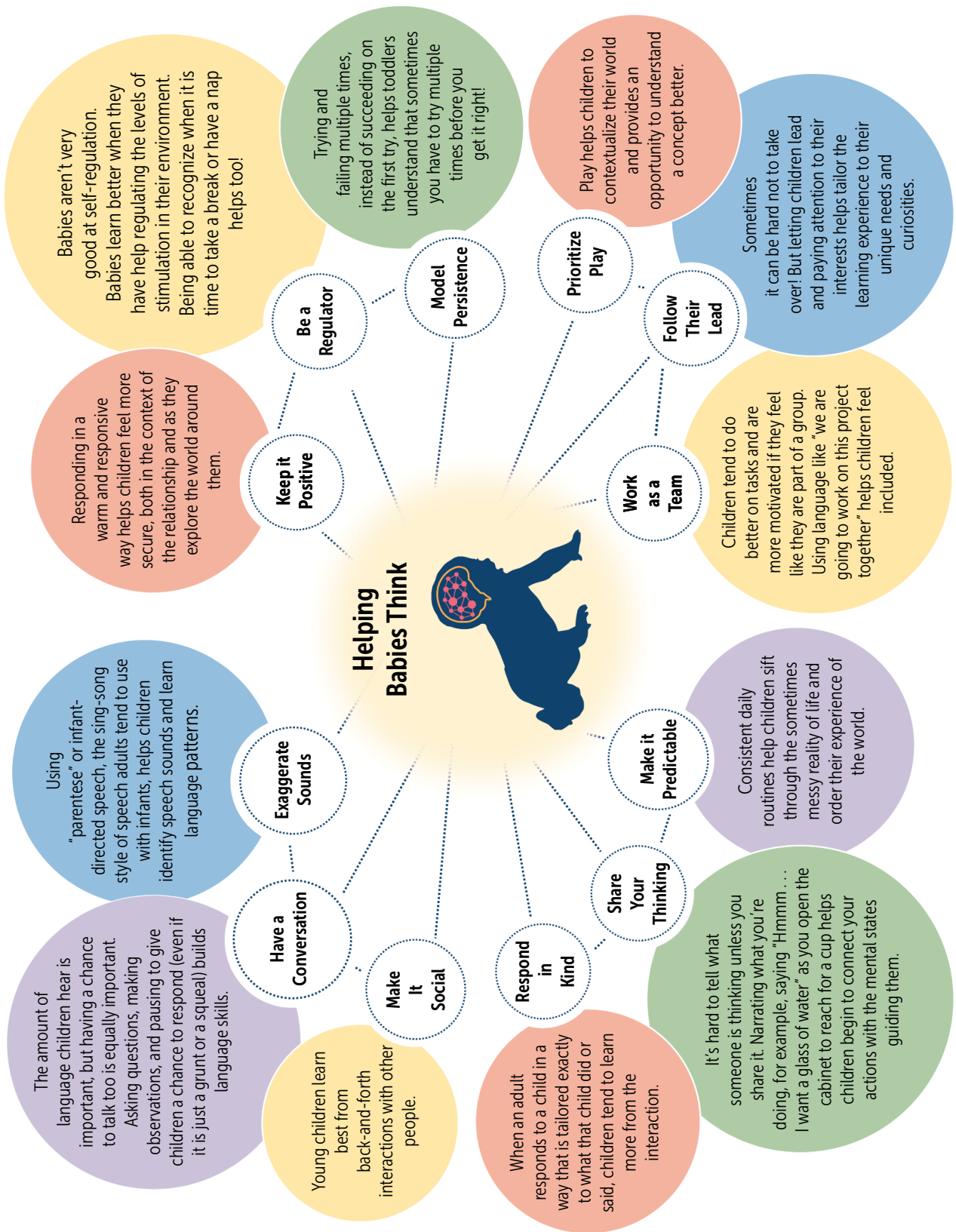
Conclusion

The next time you are cooing along with a baby, or struggling to change a diaper mid-meltdown, or picking up a sippy cup for the umpteenth time, pause to consider the incredible detective work babies are doing every moment of every day. As an important adult in these marvelous detectives' lives, there are many ways to support their thinking and learning. We've outlined a few strategies to try in the accompanying figure (see Figure 1). While babies may be building different skills (how to make that "rrr" sound), considering different questions (is this grocery aisle safe?), and struggling with different stretch goals (Dad told me no, but I still REALLY want that kitty litter...), infants are perfectly suited to do the job they do better than anyone: learning, adapting, and thriving in a complex world.

Amelia R. Bachleda, PhD, is an outreach and education specialist at the Institute for Learning & Brain Sciences at the University of Washington. As a trained science communicator, she works to put the latest science of child development into the hands of those who can act on it by developing resources and delivering trainings nationwide.

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Figure 1. Helping Babies Think



Source: Amelia R. Bachleda (I-LABS, University of Washington) and Ross A. Thompson (University of California, Davis)

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