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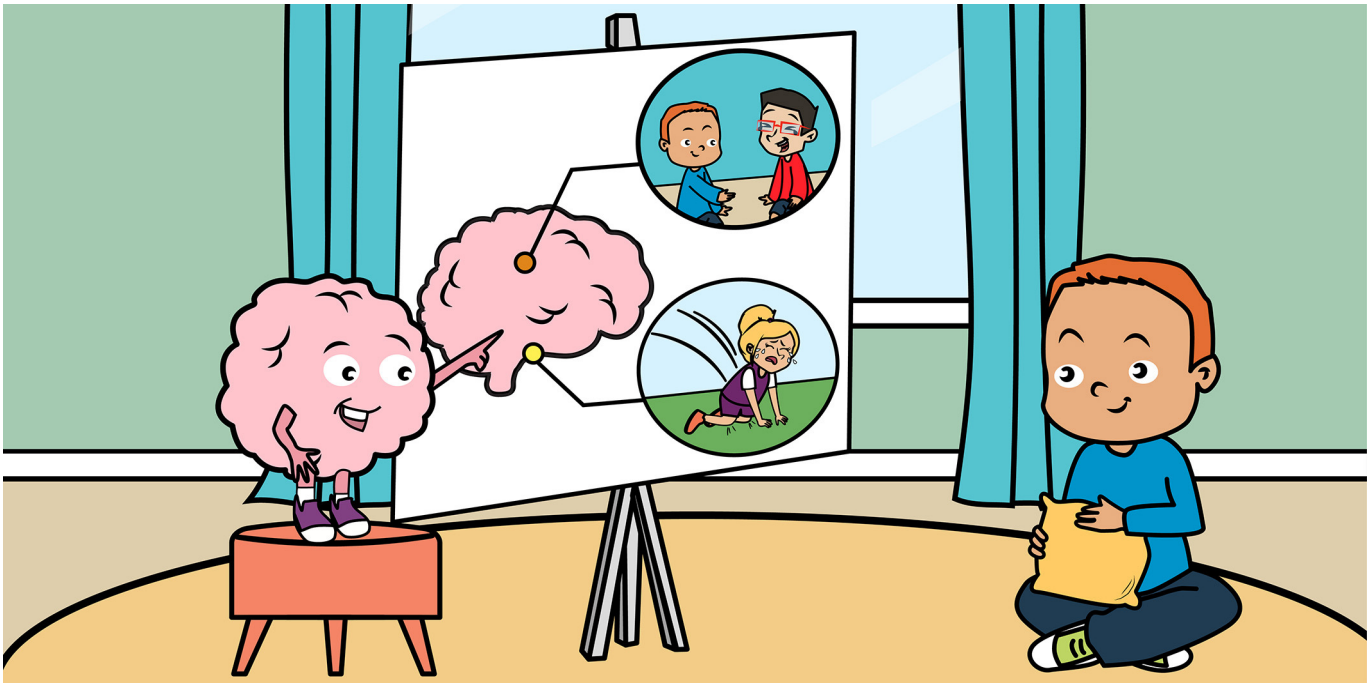

HOW DOES THE BRAIN HELP US UNDERSTAND OTHERS?

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ARIEAL COMMUNITY OUTREACH PROGRAM

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What do you think your friends are thinking when they get a compliment? How do they feel when they get a good grade at school? Thinking about other people and what they know, believe, or want is called social cognition. Certain parts of the brain are important for social cognition, and those parts work together in a network to allow us to think about others. How do we develop these social skills, starting as babies? In this article, we will introduce the parts of the brain that are important for social cognition, and we will explain how the network of brain regions that perform social cognition develops over the years, from a new-born baby to an adult.

WHAT IS SOCIAL COGNITION?

Have you ever wondered what another person is thinking or feeling? Every day, we talk to many different people and do things together with them. And it is the brain that makes this possible! The brain is involved in everything we do, and it is especially important for social experiences. Think about all the social things you experience every day: you joke around with your friends, chat with your parents and siblings, learn from your teachers at school, celebrate your grandma's birthday with her, and so on. All these people are part of your **social network**: the group of people that you have interactions with. When you interact with other people, and also when you just look at them or think about them, you might try to imagine how they are feeling or what they are thinking (Figure 1).

SOCIAL NETWORK

All the people you talk to and do things with.

Figure 1

When we interact with other people in our social networks, or even when we just think about them, we might try to imagine what they are thinking or feeling (Figure credit: Jule Schretzmeir).

Figure 1

Cognition means thinking, learning, and understanding things. **Social cognition** is a special kind of cognition that involves thinking about what other people know, want, or feel. Social cognition helps us understand how our friends feel when they open a present they have wanted for a while, or how one of our classmates feels when he or she gets a good grade. This may sound easy, but it is actually quite remarkable! Since we cannot read other people's minds, we *imagine* how others feel, what they think, or what they know. This is a very important human skill.

COGNITION

Thinking, learning, and understanding things.

SOCIAL COGNITION

Thinking about what others know and how they feel.

WHICH PARTS OF THE BRAIN ARE IMPORTANT FOR SOCIAL COGNITION?

Specific parts of the brain help us to think about others (Figure 2). Let us start at the front of the brain, which is called the **prefrontal cortex**. If you touch the middle of your forehead, you will point at this part of your brain. The prefrontal cortex is responsible for many things: remembering, making decisions, planning, and social cognition [1]. The prefrontal cortex helps us to put ourselves in someone else's shoes, which means that this part of the brain becomes active when we imagine how another person feels or thinks.

PREFRONTAL CORTEX

The front of the brain.

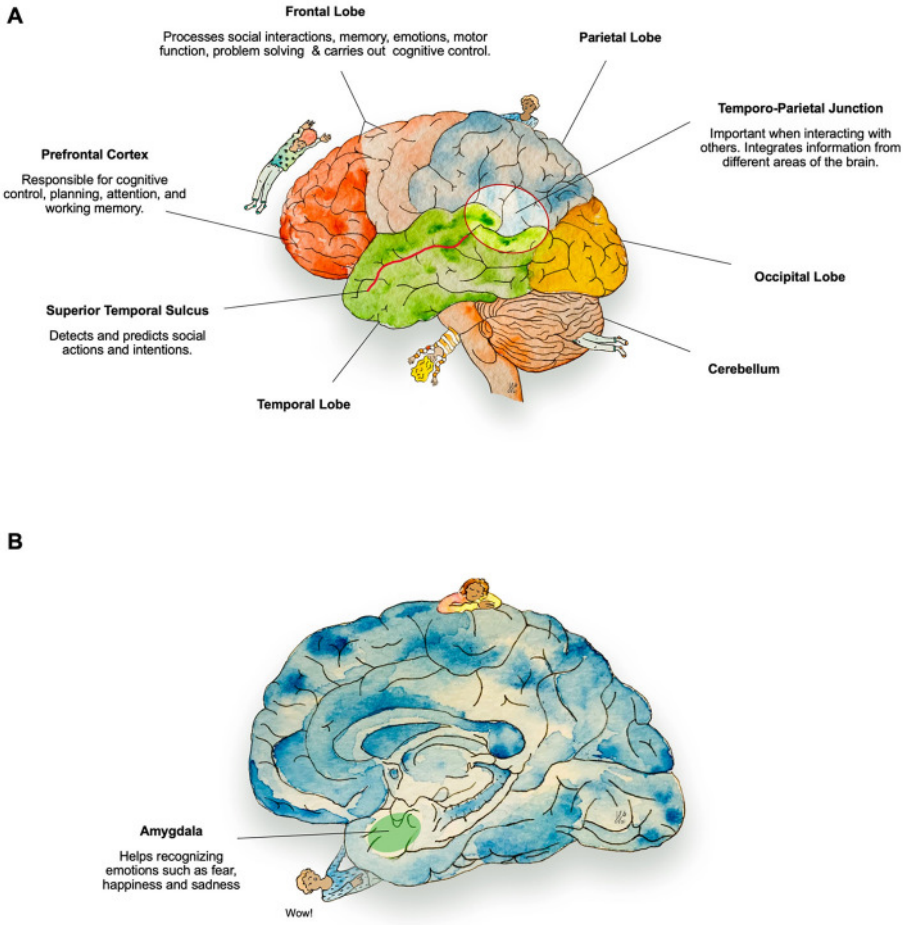

Figure 2

The parts of the brain that help us think about others. **(A)** When thinking about others, we use various lobes of the brain, including the prefrontal cortex (bright red), the superior temporal sulcus (thick red line), and the temporoparietal junction, where the temporal and parietal lobes meet (circled area). **(B)** The amygdala (in green) is also important when you think about others, for recognizing the look on someone's face, for example (Figure credit: Jule Schretzmeir).

AMYGDALA

The small, almond-shaped area of the brain.

Another brain region that helps with social cognition is the **amygdala**. This name comes from the Greek word *amygdale*, which means almond. As you might have guessed, the amygdala is shaped like an almond! We have an amygdala on both sides (hemispheres) of the brain and even though these areas are super small, they are very important! The amygdala takes care of social cognition, but also manages our emotions and learning [2]. For example, in social cognition, the amygdala helps us to recognize the look on

someone's face and to understand whether that person looks happy, sad, or scared.

SUPERIOR TEMPORAL SULCUS

The brain "valley" at the top of the temporal lobe.

Another brain region important for social cognition is called the **superior temporal sulcus**. If you think of your brain as a mountain range with mountains and valleys, "sulcus" is the word used for the valleys of the brain. "Temporal" refers to the temporal lobe, where this valley can be found, and "superior" means that the valley is on the top of the temporal lobe.

TEMPOROPARIETAL JUNCTION

The area where the temporal and parietal lobes meet.

Very close to the superior temporal sulcus, we can find the **temporoparietal junction**. This is the region where the temporal and parietal lobes meet. Both the superior temporal sulcus and the temporoparietal junction are important when we interact with other people. Together with the prefrontal cortex, these regions become active when we imagine how other people feel or what they think [1]. The superior temporal sulcus also becomes active when we recognize the look on someone's face and, as you have learned, this region works with the amygdala to achieve this. Actually, all the brain parts involved in social cognition work together. Just as all the people in a social network help each other out, the network in the brain does the same. But when we are born, the brain regions are not yet well-connected. How do we develop these important brain connections that help us with social cognition?

SOCIAL COGNITION IN BABIES

A new-born baby needs to learn how to talk and interact with others. Luckily, babies learn quickly and, over the years, they learn to understand how others feel, how to play with others, and how to think about others (Figure 3). All through childhood, the brain is still developing. Even now, your brain is still learning more about others—and this all started when you were a baby.

Figure 3

Social cognition develops throughout childhood and our teenage years. First, babies mostly look at, listen to and start to play with others. A little later, children are already able to imagine what someone else might think. Finally, teenagers further develop their social skills by interacting with different types of people (Figure credit: Jule Schretzmeir).

When babies are born, they are already interested in people more than in objects. Babies like to listen to voices, especially the voices of their

mothers and fathers, and they like to look at human faces. In the first months of life, babies start to notice when someone talks to them, and this is an important first step toward social cognition. You may have heard someone using "baby talk" to speak to a baby—the person might speak in a higher tone of voice, repeat the same words over and over, and speak very clearly. Although this probably sounds a bit funny to you, babies like this a lot and it helps them develop language and social skills. When babies notice that someone is talking to them in a friendly manner, smiling at them, or making eye contact, their prefrontal brain areas are activated [3]. Even in the first months of life, the prefrontal region is active during social cognition.

In the first year of life, babies are not only interested in voices and faces, but they develop some social skills. For example, when a baby plays with a parent, the baby might point to a toy car. When the parent looks at this toy too, researchers found that there is more activation in the baby's prefrontal cortex. It seems that babies pay more attention to things they see when they know that *someone else* is looking at that thing at the same time! Along with many other skills babies develop in their first year, this skill helps babies to play with a toy with someone else.

SOCIAL COGNITION IN CHILDREN

Young children continue to acquire many more social skills: they learn to talk and to play with lots of different children on the playground or in school. Children start to understand that everyone has their own thoughts and feelings, and that others might see the world differently than they do. For example, some young children think that they can hide by just covering their eyes—that if they cannot see others, others cannot see them. Once children get a little better at social cognition, they begin to understand that other people can still see them when they close their eyes.

Children not only learn that everyone has their own knowledge, thoughts, and feelings—they also start to understand that sometimes people believe things that are not actually true. Imagine that your sibling thinks there is one ice cream left in the fridge. You know that that is not the case, because yesterday you ate the last ice cream after school. But you realize that, when your mom asks your sibling if there is ice cream left in the fridge, your sibling will answer yes because he or she does not know that you ate the last ice cream yesterday. This means you understand that everyone might have different beliefs: your sibling believes something different from what you know is true. Children develop these skills around 4 years of age, and researchers have shown that three brain regions become active when you understand that someone believes other things that you do not: the temporoparietal junction, superior temporal sulcus, and the prefrontal cortex [4].

Understanding that everyone has their own thoughts and feelings is a skill that keeps developing as children grow up. Even in the teenage years, children are still developing these skills! Becoming a teenager comes with some big changes in the way children feel, look, and think. Throughout these years, the brain changes too. The brain is made mostly of two types of tissue: white matter and gray matter. Throughout the teenage years, the amounts of white and gray matter in the brain change [5]—more white matter and less gray matter is formed in the prefrontal cortex, which is a very important region for social cognition! Some researchers link the reorganization of the teenage brain to changes in the social behavior of teenagers. Teenagers generally become better at interacting with different kinds of people and thinking about others and themselves. However, for a couple of years, teenagers find it a bit more difficult than before to recognize the emotions of others. They also find it more difficult to decide if they have seen someone's face before. But do not worry, once teenagers reach adulthood, their brains have mostly finished reorganizing and they do perfectly fine at recognizing emotions and faces and at the other aspects of social cognition. By the time we reach adulthood, we have developed all the skills we need to efficiently use our social brains. Although, even as adults, we can still learn and get better.

CONCLUSION

Now you know that we can think about others and what they might think or feel thanks to a bunch of parts of the brain that work together. The amygdala, prefrontal cortex, superior temporal sulcus, and temporoparietal junction form a brain network that allows us to build our very own social networks, with our families, friends, and others. This network of brain regions begins to become active when we are still new-borns, and, as we grow, it helps us to become as social as we are today. So, the next time you look at someone and know immediately how they feel or what they think, remember that there are several parts of your brain hard at work to make that possible!

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ARIEAL COMMUNITY OUTREACH PROGRAM, AGES: 8–11

The ARiEAL Community Outreach Program is based at the Center for Advanced Research in Experimental and Applied Linguistics (ARiEAL) at McMaster University, Canada. Aara (8), Adriana (8), Jaelyn (9), Kai-Ning (9), Anika (10), Maya (10), Olivia (10), Evan (11), and Sophie (11) completed this review with our senior scientific mentor, Dr. Constance Imbault, an experimental psycholinguist who focuses on empathy and emotion, and junior scientific mentors, Nadia Lana and Vidhi Patel.

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Marlene Meyer is a researcher at the Radboud University in the Netherlands. She is looking into how we develop from a newborn baby into a grownup, and how this development shows in our brain and behavior. Marlene started by earning her bachelor's degree in Cognitive Science at the University of Osnabrück (Germany) and her master's degree in Cognitive Neuroscience at the Radboud University. She completed her PhD at the Radboud University and worked then as post-doc at the University of Chicago (USA). Besides her passion for research, Marlene loves meeting friends, playing sports and board games, and traveling the world.