



The Empathy Bell Curve

By Simon Baron-Cohen

We all lie somewhere on an empathy spectrum (from high to low). That is, we can all be lined up along this spectrum based on how much empathy we have.

To explore this, we first need a definition of empathy. *Empathy occurs when we suspend our single-minded focus of attention and instead adopt a double-minded focus of attention.* Sometimes attention is compared to a spotlight, so this definition of empathy suggests our attention can be a single spotlight (shining through the darkness on our own interests)

or can be accompanied by a second spotlight (shining on someone else's interests). Single-minded attention means we are only thinking about our own mind, and double-minded attention means we are paying attention to someone else's mind at the same time. So far my definition ignores the process and the content of what happens during empathy. So we can extend the definition as follows: *Empathy is our ability to identify what someone else is thinking or feeling and to respond to that person's thoughts and feelings with an appropriate emotion.*

This suggests there are at least two stages in empathy: recognition and response. Both are needed, since if you

have the former without the latter, you haven't empathized at all. When that second spotlight works, and you are able to recognize and respond, you can sensitively avoid hurting another's feelings and consider how everything you say or do impacts that person or others. But if your attention has a single focus — your current interest, goal, wish, or plan — with no reference to another person's thoughts and feelings, then your empathy is effectively switched off. It might be switched off because your attention is elsewhere, a transient fluctuation in your state. A temporary fluctuation in one's empathy is potentially rescuable. An enduring lack of empathy, as a trait, potentially is not. My contention is that however you get to this low point on the empathy scale, the result can be the same.

This definition of empathy so far

presumes it is either present or absent (off or on), like a light bulb in the head. In reality, empathy is more like a dimmer control. On this quantitative view, empathy varies in the population along the familiar bell shaped curve or normal distribution, shown below:

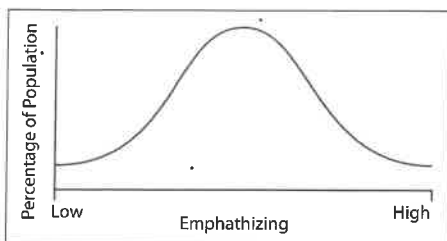


Figure 1: The Empathy Bell Curve

Measuring empathy

As part of our research into the nature of empathy, my colleagues and I developed a scale with which to measure empathy across the age range, called the Empathy Quotient (EQ). It works well in that it distinguishes people who have an empathy difficulty from those who do not.¹ It reveals, for example, that humanities students score slightly higher on EQ than science students,² and females in the general population score slightly higher on the EQ than males.³ Most importantly, EQ produces the empathy bell curve we expected to find in the population.

The adult version of EQ relies on self-report, which is of course problematic, since people might believe they are much more empathic than they really are. This is because someone with poor empathy is often the last person to realize this. But with large samples such “noise” in the data is probably minimal. We went on to develop a child version of EQ, filled in by a parent, and again found that on average girls have a slightly higher EQ than boys.⁴

The empathy circuit

What leads an individual’s empathy to be set at different levels? The most immediate answer is that it likely depends on the functioning of a special circuit in the brain, what I call the “empathy circuit.” Thanks to functional magnetic resonance imaging (fMRI), scientists are getting a

clear picture of the brain areas that play a central role when we empathize. There is a consensus in neuroscience⁵ that at least 10 interconnected brain regions are involved in empathy. See Figure 2. Imaginative experiments using neuroimaging have revealed the different parts of the empathy circuit.

The **medial prefrontal cortex (MPFC)** is thought of as a “hub” for social information processing and is important for comparing your own perspective to someone else’s.⁶⁻⁸ It divides into the dorsal (dMPFC) and the ventral part (vMPFC). The dMPFC is involved in thinking about other people’s thoughts and feelings^{6,9} (sometimes called “meta-representation”) as well as thinking about our own thoughts and feelings.^{7,10} The vMPFC seems to be used more when people think about their own mind more than someone else’s, and in self-awareness.^{7,11-13}

The **orbito-frontal cortex (OFC)** is activated when people are asked to judge which words described what the mind could do.¹⁴ Patients with damage in the OFC have difficulty judging when a faux pas occurs, an indicator of difficulties with empathy.¹⁵ Damage to the OFC can also lead to patients losing their social judgment, becoming socially “disinhibited.” In addition, when you see a needle going into a normal (but not an anesthetized) hand, the OFC is active, suggesting this part of the empathy circuit is involved in judging whether something is painful.¹⁶

The **frontal operculum (FO)** is part not only of the empathy circuit but the language circuit too. The FO is equivalent to an area in the monkey brain involved in coding other people’s intentions and goals.¹⁷ That is, when a monkey (with a deep electrode in its brain) sees another monkey reaching for an object, cells in the FO increase electrical activity, and the same cells fire when the monkey reaches for an object.

Damage to the **inferior frontal gyrus (IFG)** can produce difficulties in emotion recognition.¹⁸ One interesting experiment involved looking at facial expressions such as those in Figure 3 on the next page (happy, sad, angry, and disgusted). This found that disgust is mostly processed in the anterior insula (AI),¹⁹ which will be

described below, happiness is mostly processed in the ventral striatum, anger is mostly processed in the supplementary motor cortex, and sadness is processed in a number of regions, including the hypothalamus.²⁰ The one brain region that consistently correlated with a person’s EQ, regardless of which emotion the person was viewing, was the IFG. The better your empathy, the more active your IFG when looking at emotional faces.

The **caudal anterior cingulate cortex (cACC)**, also called the **middle cingulate cortex (MCC)**, is involved in empathy because it is activated as part of the “pain matrix.” This region is active not only when you experience pain but also when you observe others in pain.²¹ The **anterior insula (AI)** plays a role in bodily aspects of self-awareness, itself closely tied to empathy.²² When a person receives a painful stimulus on the hand or witnesses the painful stimulus be applied to his or her partner’s hand, the AI and the cACC/MCC are activated, whether you are experiencing your own pain or perceiving your loved one’s pain.²³ And if you watch someone’s hand being caught in a door, the AI and cACC/MCC are also activated.²⁴

The **temporal-parietal junction** on the right side (**RTPJ**) has been found to play a key role in empathy, particularly when

For a related story, see page 16.

judging someone else’s intentions and beliefs.²⁵ This is relevant to the recognition element of empathy, or to what is called a “theory of mind.” We use our theory of mind when we try to imagine someone else’s thoughts.

Animal research shows that cells in the **superior temporal sulcus (pSTS)** respond when the animal is monitoring the direction of someone else’s gaze.²⁶ In addition, damage to the pSTS can disrupt a person’s ability to judge where someone else is looking.²⁷ Clearly, we look at another person’s eyes not just to see *where* he or she is looking but also to sense what the person might be *feeling* about what he or she is looking at.²⁸ The pSTS is also involved when you observe “biological motion” (animate, self-propelled kinds of movements that living creatures make).²⁹

The **somatosensory cortex (SMC)** is involved in coding when you are having a tactile experience and by observing others being touched.³⁰⁻³⁴ And when you watch a needle piercing someone else’s hand you get a burst of electrical activity in the somatosensory cortex, also seen using fMRI.^{35,36} This strongly suggests that we react in a very sensory way when we identify with someone else’s distress. This clear brain response is telling us that even without any conscious decision to do so, we must be putting ourselves into the other

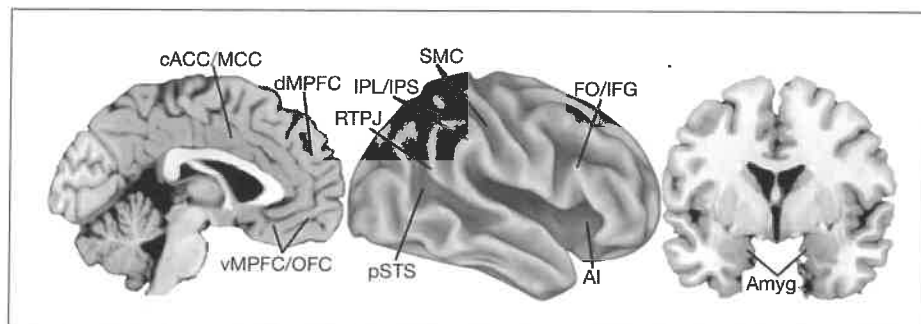


Figure 2: Regions in the social brain. Acronyms are explained in the text.



Figure 3: Examples of emotive faces clockwise from upper left: happy, disgusted, sad, and angry.

person's shoes, not just imagining how we would feel in the individual's situation, but also actually feeling it as if it had been our own sensation. No wonder we wince involuntarily when we see someone else get hurt.

The FO/IFG connects to the **inferior parietal lobule (IPL)**, both part of the "mirror neuron system," regions of the brain that are active when you perform an action and when you observe someone else performing the same action. The existence of mirror neurons in primates³⁷ was discovered by placing electrodes into parts of the brain to record nerve cells that fire not only when the animal is performing an action but also when the animal sees another animal performing the same action. If the IFG is part of the human mirror neuron system, this suggests empathy involves some form of mirroring other people's actions and emotions.^{38,39}

The mirror neuron system in humans is hard to measure, obviously because it is unethical to place electrodes into the awake human healthy brain. But using fMRI it appears to span the IFG, and the **inferior parietal sulcus (IPS)** just posterior to the IPL.

The **amygdala (Amyg)** is involved in emotional learning and regulation processing.^{40,41} New York University

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neuroscientist Joseph LeDoux argues the amygdala is at the center of "the emotional brain"⁴² because of his extensive studies about how we learn to fear something. When my colleagues and I asked people to look at other people's eyes to make judgments about their emotions and mental states, while they were lying in the fMRI scanner, the amygdala was clearly activated.⁴³

Another clue that the amygdala is part of the empathy circuit comes from a famous neurological patient, known by her initials S. M. She has very specific damage

to both Amyg (we all have one in each hemisphere). Despite having good intelligence, her main difficulty is not being able to recognize fearful emotions in others' faces.⁴⁴ This difficulty S. M. has in recognizing fearful faces is related to the fact that the eyes are critical for recognizing fear in someone's face. S. M.'s damage in the amygdala affects her ability to make eye contact, which is why she has difficulty recognizing fearful faces.⁴⁵ We know this because, when directed to attend to the eyes, she regains the ability to recognize fearful faces.⁴⁶

This brief tour of the 10 major brain regions involved in empathy allows us to talk about an empathy circuit in the brain. And there are multiple connections between these regions too. Finding that these regions vary in activity in different individuals according to the person's particular level of empathy⁴⁷ supports the idea of empathy varying like a dimmer control. And it gives us a direct way of explaining people who for different reasons (people with autism, or Asperger syndrome, or one or other of the personality disorders) have little or no empathy. ■

For more about empathy and autism, see page 22.



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Lifespan Asperger Syndrome Service. His latest book, *The Science of Evil*, will be published in June by Basic Books and in April by Penguin UK as *Zero Degrees of Empathy*. Earlier books include *Prenatal Testosterone in Mind* (MIT Press, 2005), *The Essential Difference: Men, Women and the Extreme Male Brain* (Penguin UK/Basic Books, 2003), and *Mindblindness* (MIT Press, 1995). He has edited or co-edited a number of scholarly anthologies and written books on his areas of expertise for parents and teachers. Baron-Cohen also serves as an editor-in-chief of the online open access journal *Molecular Autism*. He has been awarded prizes from the American Psychological Association, British Science Association, and British Psychological Society for research on autism. Baron-Cohen earned degrees from University of Oxford (B.S. in Human Sciences), the Institute of Psychiatry, King's College London (M.Phil. in Clinical Psychology), and University College London (Ph.D. in Psychology). His article "The Essential Difference: The Male and Female Brain" appeared in the winter/spring 2005 edition of this magazine. Email him at sb205@cam.ac.uk.



For footnotes, go online to www.phikappaphi.org/forum/spring2011.