MIND FOUNDATION

Social interoception

DATE PUBLISHED

1 May 2020



> *The growing field of social interoception—which examines how social emotions arise from subjective appraisal of bodily states—calls for a rebranding of mental health issues as "social health issues" and builds the case for new forms of embodied social treatment, including psychedelic-assisted therapy. I spoke with researchers at UC San Diego, the University of Utah's Social Development Lab, and the University of Zurich to find out more.*

It was by studying a part of the brain called the insula that neuroscientist John Allmann first realized self-awareness and social awareness are part of the same functioning1. Tucked deep within the Sylvian fissure, a connectivity hub disguised as an island unto itself, the insula is one of the main brain structures responsible for translating body states into social emotions. It starts doing this for us the moment we are born, recasting intimate touch into feelings of pleasure or a harsh tone from a parent into feelings of shame. If we do not receive appropriate care as children, the way the insula encodes the relationship between our bodies and social emotions can cement in a maladaptive way, leading to a propensity for mental health issues later in life2. Mounting evidence shows that it may be possible to change this relationship, since the insula also plays a role in therapeutic practices like mindfulness meditation, body trusting, and psychedelic-assisted therapy. Taken together, these findings suggest that the link between body, self, and social emotions plays a bigger part in mental health than we might think, highlighting a need for more forms of therapy which directly target social emotions through the body.

The bodily self

The insula's main function—helping us recognize what we are experiencing based on what we sense—is called interoception. It allows us to interpret an "empty stomach" as physical hunger or "butterflies" as excitement or fear. As mentioned above, social emotions arise from this process. Despite the connection

between interoception and social emotions, little scientific attention has been given to the social origins of interoception.

At the University of Utah's Social Development Lab, Kristina Oldroyd's pioneering work suggests that early social experiences significantly impact areas of the brain responsible for interoception by influencing the development of the bodily self. Oldroyd's research team has found that insensitive caregiving—which includes responding inconsistently to a child's needs or rejecting distress altogether—can impair a child's ability to form accurate representations of bodily sensations3. For example, when a child who is learning to walk falls down and feels physical pain, a sensitive response from a parent might be, "That must have hurt," whereas an insensitive response would be, "You're fine, that didn't hurt, get back up." For the child to become comfortable detecting, acknowledging, and expressing bodily cues, the parent must notice what the child is experiencing, draw joint attention to it, and label it3:

"To the extent that caregivers recognize, honor, and respect their children's bodily experiences, the child will develop more accurate interoception," Olroyd explains. "To the extent that a child's bodily experiences are denied, devalued, ignored, or punished by parents, the child will find ways to avoid feeling them, and develop a distorted sense of interoception."3

Oldroyd maintains that the way we learn to regulate physical pain is no different from the way we learn to regulate emotional pain—in both cases, we are socialized through our bodily experience. Neuroscientific studies support her theory, showing that children who are classified as having anxious or avoidant attachment styles have markedly lower insular volume than securely attached children4. If the bodily self remains unchanged throughout those children's adult lives, when relationships become more complex and social-emotional regulation increasingly important, Oldroyd believes it is poor interoception itself which may lead to disorders like anxiety, depression, and addiction. It may also lead some of us farther away from social connection when, ironically, that may be what we need the most.

Interoception and social health

"One idea I'm working with," says Andy Arnold, a psychologist and interoception expert at the University of California San Diego and Visiting Professor at Knox College, "is that interoception might be a critical mechanism for evaluating needed resources in our lives. If interoceptive understanding is turned down, then one might not be able to accurately sense the lack of needed resources [like] social connection and act accordingly." For example, addiction could be a misevaluation of resources where you "overevaluate the drug but underevaluate other stimuli in your life," Arnold told me, adding that the insula probably plays a critical role in this process.

It also works the other way around: substance abuse disrupts interoception and damages the insula. Brain images of people with alcohol use disorder show significantly reduced grey matter in the insula, marked by a profound loss of von Economo neurons (or "empathy cells")5, a relatively recent evolutionary specialization in humans thought to be crucial for interoceptive sensitivity and prosocial behavior6. Paradoxically, in certain cases, damage to the insula actually reverses addictive behaviors. In a 2015 study on addiction, researchers at the University of Southern California observed: "On the one hand, alcohol dependence damages the insula. On the other hand, damage done to the insula reduces cravings for alcohol."7

But this is not a contradiction if you view addiction as social health issue. The insula might normally motivate us to seek social reward, but if we cannot understand our social-emotional needs based on what we are feeling, we might turn to substances to resolve this uncertainty. Heavy substance use may be like putting the wrong type of fuel in the tank: when the brain and body crave social connection, giving it something else

harms the engine over time although it appears to run fine. In this case, perhaps the habitual relationship with the drug outlasts the original motivation to use it. On the other hand, damaging the insula outright may destroy its record of the substance as a substitute for social reward, and therefore immediately reduce one's craving for it.

The insula shows us just how misguided we may be in labeling disorders like addiction, anxiety, depression, and substance abuse as "mental health" issues. If interoception initially develops in the context of interpersonal relationships, then so do many of our afflictions—and so, too, should our treatments.

Connecting through the body

In November 2019, Arnold and his colleague, neuroscientist Karen Dobkins, published the first academic discussion of what they call "social interoception," arguing that interoceptive ability facilitates social connection8. To understand how interoception might work in a social situation, imagine an encounter that raises one's heart rate—a response meant to enhance alertness and prepare one for "fight or flight." Dobkins and Arnold believe it may not be one's physiological response *per se* that causes social stress, but rather one's subjective interpretation of it. They reference a series of studies by researchers in Munich who used social stress tests designed around impromptu public speaking9 and social exclusion10 in a game setting to measure interoception. The researchers found that people with higher interoceptive accuracy reported fewer negative emotions after the challenging social situation, despite their heart rate and skin conductance being similar to participants with lower interoceptive accuracy. In other words, two people can have the same internal body state but experience completely different levels of social discomfort.

"This leads to the interesting idea that perhaps greater interoceptive accuracy allows one to identify the physiological response as resulting from an objective, external 'social situation' rather than an attribute of oneself," Dobkins and Arnold say. "This could reflect better emotional regulation in social situations." Oldroyd echoes these ideas in her own work: "It is the bias to interpret bodily signals in a negative manner, rather than the noticing of bodily signals, that contributes to both the cognitive and behavioral symptoms of anxiety."

There is an important subtext to these statements: Maybe we are not born with our various social neuroses. Maybe we are born with a bias towards positive social signals, towards bonding with others. Poor interoception, often developed in the context of an adverse childhood, may be what shifts the bias towards negative signals. The way to shift it back, Dobkins says, would be to start listening to and trusting your body before your mind jumps to conclusions. In their own work on loneliness, Dobkins and Arnold found that one measure of interoception in particular—body trusting—predicted variations of subjective loneliness amongst university students at UCLA11, suggesting that connecting with your body allows you to connect with others, whether that means making more friends or different friends. The more you trust your own body, the better you become not only at reading yourself but at reading and connecting with other people.

"You know the feeling when you and another are 'on the same page'?" Dobkins says. "Well, that's *not* what I am talking about. That's the mind reporting back and saying that, 'the other person and I believe or want the same thing.' Connection is *body-based*. It's a knowing in the body. Which means you need to know your body."

The growing field of social interoception may help us better understand and treat not only loneliness but anxiety, addiction, eating disorders, depression, and other conditions traditionally associated with thought patterns rather than body signals. In fact, social interoception may be a key piece in the puzzle of explaining how psychedelic-assisted therapy functions.

Psychedelic drugs and interoception

As part of the Salience Network, one of the main functions of the insula is to orchestrate activity between other networks, including the Default Mode Network and the Central Executive Network. In 2017, Robin Carhart-Harris and his research team at Imperial College London found hypo-connectivity of the insula to be “a neurobiological signature of the MDMA experience,” correlating it with reduced anxiety, altered bodily sensations, and changes in interoception12. “Further understanding of how MDMA affects the insula,” Carhart-Harris writes, “might be crucial to elucidating the neurobiological underpinnings of re-emerging interest in MDMA as a therapeutic adjunct to psychotherapy in the treatment of anxiety disorders including PTSD.” Other teams have found similar results, linking insula hypo-connectivity to the LSD experience13.

Research on the neural correlates of different types of mindfulness meditation points to the insula and the body as well. Commenting on a study on Loving Kindness, Focused Attention, Open Monitoring, and Mantra Recitation, Carhart-Harris notes that although these four meditation styles are clearly dissociated by their neural correlates, there are “a few recurrent patterns of activity modulation, in particular in the insula, an important multisensory area heavily involved in interoceptive awareness”14. He suggests that involvement of the insula in all four styles of meditation points towards “the central role of the attentional control of bodily awareness, and awareness of breathing in particular, during various contemplative practices.” As we’ve seen, body awareness is closely linked to social emotion, which may help explain the benefits of both mindfulness meditation and psychedelic therapy.

Psychedelics and connectedness

At the University of Zurich, Katrin Preller studies the social health benefits of psychedelics. Her work in this area confirms Allmann’s notion that how we see ourselves is inextricably intertwined with social perception. For example, psilocybin and LSD have been found to reduce social pain specifically through alterations in self-processing15, which include experiences of unity and connectedness.

“One of the main aspects of the psychedelic experience is the sense of connectedness – with the universe, nature, but importantly also with the social environment,” Preller told me. “Furthermore, we see an increase in emotional empathy which may be an important factor contributing to the feeling of connectedness. In clinical trials, we are currently testing the hypothesis that this experience contributes to the efficacy of psychedelic-assisted therapy.”

In a successful series of Johns Hopkins studies targeting psilocybin and nicotine addiction, participants “identified social factors, i.e., smoking as a way of connecting with other people, that contributed to their addiction.”16 They reported psilocybin-induced feelings of love and connection with their environment and other people, independent of smoking as a social factor, as important for quitting smoking17. “Psilocybin may have re-instated social reward processing, helping patients to overcome their addiction,” Preller speculates. “My hope is that therapy will focus more on social cognition and the social environment of patients. For example, social trainings may aim at re-instating social reward processing in addicted patients, helping them to re-connect with their social environment.”

Research on the insula and social interoception suggest that the body is the main channel through which these changes must occur. Feelings of love and connection are exactly that—feelings. It seems we must feel the social reward, hold it in our bodies, to stop needing its replacement. In doing so, maybe we restore some kind of default setting. For all we know, “connectedness” may not be an additive feeling at all. On the contrary, it may be the stripped-down, primordial sensation that the self is socially constructed. And while it may be a

new feeling to the psyche, Oldroyd's work suggests it is not a new feeling to the body. Perhaps this is why psychedelic experiences can feel so profound to some: deep in their bodies, they've always known.

From global connectivity to local plasticity

In April 2019, researchers at Johns Hopkins University published an animal study showing that MDMA re-opens a "critical period" when the mouse brain is sensitive to learning the reward value of social behaviors18. Although it is a neurobiological study, attributing the reopening to heightened, oxytocin-induced brain plasticity, the behavioral mechanism sounds very much like Oldroyd's childhood theory of interoception: Critical periods were first described in snow geese in the 1930s when goslings were found to bond with an object if their mother disappeared 24 hours after they hatched, but not 48 hours after they hatched. You can imagine which goslings would be best able to socialize their bodily cues going into adulthood, assuming geese are self-aware enough to do so. In the Hopkins study, adult mice who were given MDMA showed prosocial behavior in a way normally seen only in juveniles, forming positive associations between companionship and a certain type of bedding in their enclosure. Neuroscientist Gül Dölen and her team found that this happened only if the drug was given to mice when they were with other mice, not if it was given to mice while they are alone. "This suggests that reopening the critical period using MDMA may depend on whether the animals are in a social setting," Dölen says.

Embodied therapy in social settings

Although Dölen suggests this kind of treatment may work in humans by strengthening the psychotherapist-patient bond, I would argue it is also a case for a different type of therapy altogether—something along the lines of social embodied therapy, or group bodywork led by psychotherapists. Social reward learning occurs through the body, in a social setting, in large part because we are socialized through our bodies early in our lives. If the therapeutic aim is adaptive social connection, then why not place a greater emphasis on *connection as therapy*?

Indeed, it seems questionable that any of us should heal as isolated subjects, when we are born to bond, and when the rest of our lives are built around connection. No matter how great your relationship is with your therapist, the dynamic is often that of an object being scrutinized under a microscope. Modern therapy still whiffs of stigmatization and quarantine—our problems so private that they must be kept a secret. Even Somatic Experiencing therapy, which at least reveals these problems to us through the body, largely treats each person in isolation. We do not necessarily have to share our problems to heal. In fact, some PTSD patients become asymptomatic after psychedelic assisted therapy sessions where no words are exchanged19. But it may be the case that we can only re-open the doorways of social learning—and heal from social illnesses—through the body, through each other, and through the part of the brain that so ironically appears to stand alone.

References

1. Chen, I (2009). Brain Cells for Socializing. Smithsonian Magazine.

2. Khalsa S et al (2018). Interoception and mental health: a roadmap. Biological Psychiatry. 10:004. doi: https://doi.org/10.1016/j.bpsc.2017.12.004

3. Oldroyd K, Pasupathi M and Wainryb C (2019). Social Antecedents to the Development of Interoception: Attachment Related Processes Are Associated With Interoception. Psychol. 10:712. doi: 10.3389/fpsyg.2019.00712

4. Lim L, Radua J, Rubia K (2014). Gray matter abnormalities in childhood maltreatment: a voxel-wise meta-analysis. J. Psychiatry 171 854–863. 10.1176/appi.ajp.2014.13101427

5. Senatorov V-V, Damadzic R, Mann C-L, Schwandt M-L, George D-T, Hommer D-W, Heilig M, Momenan R (2015). Reduced anterior insula, enlarged amygdala in alcoholism and associated depleted von Economo neurons. Brain, 10:305. doi: https://doi.org/10.1093/brain/awu305

6. Yang L, Yang Y, Yuan J, Sun Y, Dai J, Su B (2019). Transcriptomic Landscape of von Economo Neurons in Human Anterior Cingulate Cortex Revealed by Microdissected-Cell RNA Sequencing. Cerebral Cortex. 29, 2, 838–851. doi: https://doi.org/10.1093/cercor/bhy286.

7. Droutman V, Read S-J, Bechara A (2015). Revisiting the role of the insula in addiction. Trends in Cognitive Neuroscience. 10:005. doi: https://doi.org/10.1016/j.tics.2015.05.005

8. Arnold AJ, Winkielman P and Dobkins K (2019). Interoception and Social Connection. Psychol. 10:2589. doi: 10.3389/fpsyg.2019.02589

9. Werner N. S., Duschek S., Mattern M., Schandry R. (2009). Interoceptive sensitivity modulates anxiety during public speaking. Psychophysiol. 23 85–94. 10.1027/0269-8803.23.2.85

10. Werner N. S., Kerschreiter R., Kindermann N. K., Duschek S. (2013). Interoceptive awareness as a moderator of affective responses to social exclusion. Psychophysiol. 27 39–50. 10.1027/0269-8803/a000086

11. Arnold AJ, Dobkins K (2019). Trust Some Body: Loneliness is Associated with Altered Interoceptive Sensibility [Abstract and Poster]. Emotion Preconference for Society for Personality & Social Psychology, Portland, Oregon.

12. Walpola, I, Nest T, Roseman L, et al (2017). Altered Insula Connectivity under MDMA. 42**,** 2152–2162. doi: 10.1038/npp.2017.35

13. Preller et al (2019). Changes in global and thalamic brain connectivity in LSD-induced altered states of consciousness are attributable to the 5-HT2A receptor. doi: 10.7554/eLife.35082

14. Millière R, Carhart-Harris RL, Roseman L, Trautwein F-M and Berkovich-Ohana A (2018). Psychedelics, Meditation, and Self-Consciousness. Psychol. 9:1475. doi: 10.3389/fpsyg.2018.01475

15. Preller KH, Schilbach L, Pokorny T, Flemming J, Seifritz E and Vollenweider FX (2018). Role of the 5-HT2A Receptor in Self- and Other-Initiated Social Interaction in Lysergic Acid Diethylamide-Induced States: A Pharmacological fMRI Study. Journal of Neuroscience. 38 (14) 3603-3611. doi: 1523/JNEUROSCI.1939-17.2018

16. Noorani T, Garcia-Romeu A, Swift TC, Griffiths RR, Johnson MW (2018). Psychedelic therapy for smoking cessation: qualitative analysis of participant accounts. J Psychopharmacol. 32:756–69. doi: 10.1177/0269881118780612

17. Preller KH and Vollenweider FX (2019) Modulation of Social Cognition via Hallucinogens and “Entactogens”. Psychiatry 10:881. doi: 10.3389/fpsyt.2019.00881https://doi.org/10.1038/s41586-019-1075-9

18. Nardou R, Lewis EM, Rothhaas R. et al. (2019). Oxytocin-dependent reopening of a social reward learning critical period with MDMA. Nature **569,** 116–120.

19. The Tim Ferriss Show Transcripts: Marcela Ot’alora—How to Become a Psychedelic Therapist (#396): https://tim.blog/2019/11/25/marcela-otalora-transcript/