



Do you feel lonely? You are not alone: lessons from social neuroscience

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Reviewed by:



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16 years old

Have you ever felt left out, isolated, rejected, and/or frustrated that your parents, your siblings, or even your classmates do not seem to understand you? If so, you are not alone. In the 1980s, scientific reports indicated that 2 out of 10 people felt socially isolated at any given time. Two recent national surveys indicate that this number has now doubled. Children and adolescents are not spared from loneliness. As many as 80% of those under the age of 18 years report feelings of loneliness at some point [1]. As an illustrative case, a survey conducted from April 2008 to March 2009 by the National Society for the Prevention of Cruelty to Children (NSPCC) in the United Kingdom reported that approximately 10,000 children contacted their help line regarding loneliness-related issues. Figure 1 shows that most of these phone calls came from 16-year-old children [2]. Given the rise in reports of people feeling lonely, a growing number of research laboratories have begun to investigate the causes and consequences of loneliness. In this article, we review the literature in this field and suggest a few actions that one might take when feeling lonely.

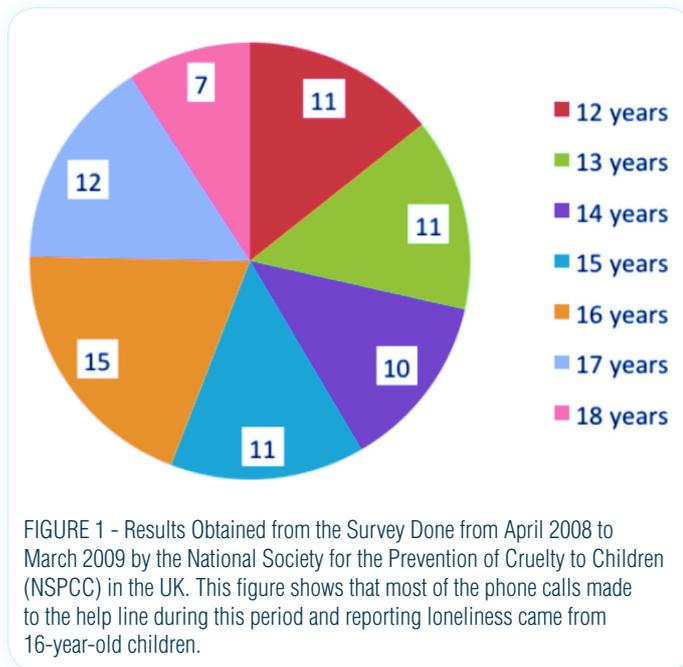
DEFINITION OF LONELINESS

Described in the scientific literature more than 30 years ago, the feeling of being lonely is characterized as feeling socially isolated or on the social perimeter [3]. It is noteworthy that feeling lonely does not necessarily mean being physically alone. Loneliness corresponds to a discrepancy between the relationships one wants and the relationships one has, so one can feel socially isolated even when they are among “friends.” As the celebrity, George Clooney, said: “Anyone would be lying if they said they did not get lonely at times. The loneliest you will get is in the most public of arenas: you will go to a place and end up in the smallest compartment

possible, because it is a distraction to everybody, and you end up not getting to enjoy it like everyone else.” Although loneliness makes people feel sad, it has another, less obvious effect on our brain and biology: it triggers a sense in which the world is unsafe, and the brain tilts toward a self-preservation mode.

CONSEQUENCES OF LONELINESS

Early in our evolutionary history as a species, we survived and prospered by banding together to provide mutual protection and assistance [4]. These deep evolutionary roots of tilting our brains and biology toward self-preservation also mean that we are unaware of much of what is triggered when we feel



socially isolated. For instance, when a school of sardines is confronted by a predator, each sardine tries to swim to the middle to evade the predator – that is, each sardine engages in self-preservation. When rodents who have been socially isolated are placed in an open field, they walk around the outside walls of the field rather than in the middle to better escape if a flying predator were to appear – that is, they engage in self-preservation. These animals do not contemplate their circumstance, their brains have evolved to act in a way that makes it more likely they will survive.

When human feel socially isolated, their brains, too, switch automatically into a self-preservation mode of information processing. As a result, when a person feels lonely, they tend to become more defensive and focused on their own welfare and self-preservation. Research suggests that this is not a conscious decision on their part. Rather studies suggest that when a person feels lonely, their brain is tuned to detect automatically negative social information more than positive social information. Consequently, a lonely person may become more hostile and defensive when talking with people (as they may hear more criticisms than compliments), and because they are

focused on their own welfare they appear to be less socially skilled.

Studies recording brain activity from lonely people are consistent with this self-preservation hypothesis. The scans show that when individuals feel lonely, their brains show more activation in the visual cortex (the part of the brain, at the very back, that processes information coming specifically from the eyes) to images of another person in distress, and their brains show less activation in another visual area involved in understanding and sharing others' emotions (empathy) and in understanding others' viewpoint from their perspective (perspective taking), as would be expected if the stimulus prompted their brain to automatically focus on their own self-preservation rather than the welfare of the person in the image they viewed [5] (Figure 2).

That said you do not often hear people complaining or talking about feeling lonely because loneliness is stigmatized – the psychological equivalent of being incorrectly labeled a weak person or even worse, a loser in life (neither of which is actually correct). People, including children, can be really good at hiding what they feel, and at putting their public smiling faces on to get through the days at school or while with family. No one wants to feel different or rejected. But the denial of loneliness is counterproductive. Like thirst or hunger, loneliness should be considered as a biological warning signal sent out by our brains. Ignoring this signal can lead to mental and physical damage and make loneliness harder to escape.

SOCIAL NEUROSCIENCE OF LONELINESS

Developed 20 years ago [6], the field of social neuroscience brings together a broad range of scientists, disciplines, and methodologies dedicated to investigate the biological mechanisms of social interaction across species [7]. Social neuroscience is dedicated to investigate the hard problem of the mutual influence of biology and social mechanisms in various topics. Social neuroscience can, thus, shed light on the study of loneliness, its mechanisms, and

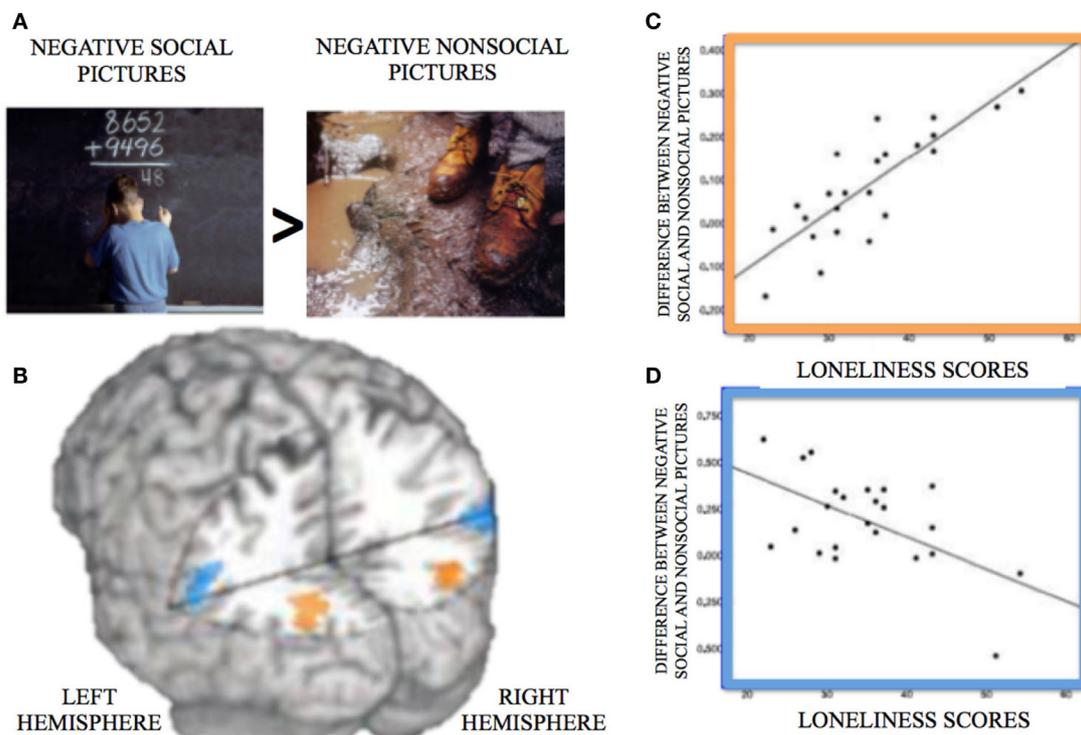


FIGURE 2 - A. Example of negative social and non-social pictures used in brain imaging experiments.

B. Functional neuroimaging results illustrating the differences in the comparison between the brain activity obtained from lonely versus non-lonely participants while they were looking at negative social pictures compared to the brain activity from the same participants while they were looking at negative non-social pictures. Results are shown on an average human brain. The visual cortex (in orange) shows more activation for negative social pictures than for negative non-social pictures in lonely people, in contrast to non-lonely, they show more activation in the visual cortex. The temporoparietal junction (which is involved in empathy and perspective taking, shown in blue) shows less activation to negative social pictures compared to negative non-social pictures in lonely people.

C. The scatter plot depicts the significant positive relationship between loneliness scores and activation of the right visual cortex in response to negative social pictures compared to negative non-social pictures, suggesting that the more participants reported feeling lonely, the more the right visual cortex was activated.

D. The scatter plot depicts the significant negative relationship between loneliness scores and activation of the right temporoparietal junction in response to negative social pictures compared to negative non-social pictures, indicating that the more participants reported feeling lonely, the less the right temporoparietal junction was activated [10].

treatments [3]. Over the past 20 years, results in this particular branch of social neuroscience have been striking. For instance, humans are a social species, but we are not the only social species. When members of non-human social species are socially isolated, they fare poorly, as well. In addition, research has shown that loneliness in humans, when not treated, can be a strong risk factor for mortality. Consider what we know about your changes of dying prematurely as a result of various conditions: Air pollution, for instance, represents about 5% increase in odds that a person will die early. Obesity represents about a 20% increase in

odds that a person will die early. Excessive alcohol consumption represents about a 30% increase in odds for mortality. A recent scientific analysis indicates that loneliness represents a 45% increase in odds for dying early. In addition, loneliness can have a broad range of negative effects on both physical and mental health. Among the most common physical health issues that are associated with social isolation are increased cardiovascular risks (risks of having heart diseases and/or high blood pressure), increased stress hormone levels, increased response of one's body to an injurious agent (such as viruses, microbes), less restorative sleep, and altered

gene expression that then lead to a weaker immune system, and also to a broad variety of behavioral disorders, such as impulsive behaviors (acting as an impulse, without consideration of the consequences), alcoholism, depressive symptomatology (including depressed and irritable mood, lost of interest in activities that you are used to doing in your everyday life, sadness, lost of energy), and suicidal ideation [3]. For instance, Caspi et al. [8] found that perceived social isolation in adolescence and young adulthood predicted how many cardiovascular risk factors (e.g., body mass index, waist circumference, blood pressure, cholesterol) were elevated in young adulthood, and that the number of developmental occasions (i.e., childhood, adolescence, young adulthood) at which participants were lonely predicted the number of elevated risk factors in young adulthood [8]. Among the most common mental health issues associated with social isolation in adults are a cognitive decline, memory difficulties, early onset dementia, and Alzheimer's disease [3].

Interestingly, similar negative effects of social isolation on physical and mental health have been described across species, from fruit flies to apes. For instance, social isolation has been shown to decrease the lifespan of fruit flies, promote the development of obesity in mice, alter brain regions that are important to control impulsivity in mice, decrease the size of some brain regions that are not being used due to a lack of social interactions in locusts, honeybees, grasshoppers, canaries, rodents and non-human primates, increase the stress response in rats, alter gene expression regulating stress response in piglets and immune function in mice rats, and increase morning rise of stress hormone, which is known to suppress the immune system in squirrel monkeys (e.g., Ott and Rogers [9]; for reviews see Cacioppo and Patrick [3] and Cacioppo and Hawley [5]). Together, these experimental studies from epidemiological, genetic, preclinical studies in social neuroscience show that the way individuals live in (or even perceive) their social environment has profound consequences on their physical and mental health.

IF LONELINESS CAN BE DANGEROUS, WHAT CAN WE DO ABOUT IT?

When we are hungry, we can go to the refrigerator and get a snack. When we are thirsty, we can go to our faucet and draw a glass of water. But when we feel lonely, we have no pantry full of friends with whom to connect. And no on-line social networking does replace the comforting touch or face-to-face meeting with a confidant. It all depends on how you use on-line social networking. Knowing how to use social networking can be viewed like knowing how to use a car. For instance, you can drive a car to pick up your friends and then meet them face-to-face to share good times with them. Or you can drive alone and watch your friends having fun on the side of the road. How we use technologies can lead to more integration, rather than more social isolation. For instance, people who seek to meet others tend to be more authentic in their computer-mediated communications than in face-to-face interactions, and marriages that begin on-line are slightly more enduring and satisfying than marriages that begin offline.

There are three main steps to break loneliness (see video). First, do not ignore loneliness. Instead, recognize what it is signaling. When you are thirsty, you recognize that you need water. When you are hungry, you recognize that you need food. When you feel lonely, recognize that you need a confidant. Second, understand what loneliness does to your brain, body, and behavior. Being socially isolated is dangerous for all social species, and our brain has evolved to focus on our own self-preservation. This brings with it some unwanted effects on your thoughts, and behaviors toward others, including increased egocentrism, impulsivity, and hostility. Such reactions may or may not be justified when interacting with others, so be sure that what you "see" in another person is coming from them and not a projection from you. Third, respond to the signal, understanding that it is not the quantity of friends, but the quality of friends that counts. It is not about becoming the most popular; it is about

developing one high-quality relationship in which both enjoy the company of the other.

If the obstacles to connection seem overwhelming, consider volunteering for an activity that you enjoy at school, in family and/or in your neighborhood, serving food to the needy; volunteering at a museum, at the library, or at the zoo; or taking time to visit elders in a retirement home. Sharing good times with others is one of the keys to connection. Do not put it off. The next time if you feel socially isolated or rejected, treat this alerting signal in the same way you would hunger or thirst, and get connected!

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I am a high school sophomore and self-confessed science geek. My dad is a Psychology professor and I have grown up around scientists and experiments. I am fascinated by the brain but also love chemistry, physics, and archeology. My particular interest in neuroscience is the way in which the brain develops over a persons lifetime.

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Director of the High Performance Electrical Neuroimaging (HPEN) Laboratory, Stephanie studied how one's social relationships modify one's brain, and vice versa. She has received several awards for her work on the science of social connection and pair bond.



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Director of the Center for Cognitive and Social Neuroscience at the University of Chicago, John is interested in the neural, hormonal, cellular, and genetic mechanisms that underlie the social structures and processes that define humans and other social species. One lens through which he has investigated the influence between these biological and social structures and processes is to study the effects of social isolation, real or perceived.