Why We Experience Loneliness: An Evolutionary Perspective

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Introduction

Loneliness is the perception, regardless of reality, that one's social needs aren't being met (Hawkley & Cacioppo, 2010), or that one is socially isolated (Cacioppo, Hawkley, Norman, & Berntson, 2011). The term "social pain" is often used synonymously with "loneliness" and "perceived social isolation" in research literature, and will be used for this paper (Cacioppo, et al., 2011). Usually, according to Hawkley and Cacioppo (2010), loneliness is measured using some sort of survey, like the UCLA loneliness scale (see Appendix A). Physiological aspects of loneliness have been studied. Biological responses to loneliness in the neural circuitry have been noted and are similar to the neural circuitry of the physical pain response system (Eisenberger, Lieberman, & Williams, 2003). Loneliness has also been linked to poor physical and psychological health demonstrating long-term impact (Hawkley & Cacioppo, 2010). From an evolutionary standpoint the experience of loneliness may have served as a trigger to certain mechanisms that motivated humans to reestablish or form social bonds, thereby increasing their chances of survival and reproduction (Hawkley & Cacioppo, 2010). Additionally, mammalian infants require extended attention and care in order to successfully reach reproductive age; thus, evolutionarily-speaking, biological systems for social connections between a caregiver and an infant would have been necessary to maintain close social bonds to ensure survival until reproductive age (Eisenberger, 2006). Researchers see these biological systems that respond to social pain, by noting brain activity during exclusion experiments (Eisenberger, et al., 2003). The fact that social pain was processed using the same regions of the brain as physical pain supports the hypothesis that social pain evolved onto the physical pain system to handle social pain parallel to the way the brain handles physical pain: by motivating humans to resolve the source of their discomfort (Eisenberger, et al., 2003; Eisenberger, 2006).

Literature Review

Eisenberger, Lieberman, and Williams (2003) conducted an experiment to test the hypothesis that the neural circuits that process physical pain are also responsible for processing social pain. In this experiment, the dorsal anterior cingulate cortex (dACC) and the right ventral prefrontal cortex (RVPFC) were the portions of the neural circuitry observed. The experiment required that participants be hooked up to an fMRI scanner, and then participated in a virtual ball-tossing game. Ultimately, each participant hooked up to the fMRI scanner was excluded from participating during the ball-tossing game. The researchers were able to monitor how this exclusion revealed itself in the neural network and how that compared to the physical pain response in the neural network. Participants were also asked to report on their feelings of exclusion (see Appendix B for scatterplots demonstrating connection between self-reported distress and brain activity). The fMRI revealed that the dACC, responsible for distress associated with pain, was more active during exclusion than during inclusion. Additionally, the RVPFC, responsible for the regulation and inhibition of distress associated with pain, showed a negative correlation with explicit social exclusion, as opposed to inclusion, suggesting that the RVPFC may regulate distressing feelings of social pain in addition to its playing its role in regulating distress associated with physical pain.

Scientists MacDonald and Leary (2005) also propose that threats to a person's social connections are processed, at least partially, by the same neural systems that process physical pain. MacDonald and Leary specifically observe how certain opiates and opioid antagonists, which are known to deal with physical pain, additionally affect social pain. They hypothesize that this is an evolutionary adaptation that ensured survival via inclusion into social groups and forming social connections. MacDonald and Leary hypothesize that social animals required adaptations that would allow them to detect and react to threats to their social safety, like during exclusion. They postulate that social pain, like physical pain, alerts mammals to when something is wrong thereby motivating individuals to fix it. Higher levels of social connection have also been shown to have a negative correlation with back pain, labor pain, cardiac pain, and post-surgery pain, while lower levels of social connection is associated with physical ailments like chronic pain. Further correlations between physical and social pain were demonstrated by the administration of low doses of morphine, an opioid, to infant rats which consequently reduced the separation-distress cries associated with social pain. Administering the peptide oxytocin, the

"bonding hormone," elicited the same response as morphine. Conversely, administering opioid antagonists like naltrexone reversed the "relief" felt when these isolated infant rats were reintroduced to their mother or a litter mate, further demonstrating the relationship between the social and physical response mechanisms. Additionally, administering morphine to primates reduced the subjects' pursuit of social connection.

Further research done by Eisenberger (2006) suggests that the neural circuitry responsible for processing physical and social pain may have evolved out of necessity for preservational and evolutionary purposes. The purpose of Eisenberger's review was to identify the neural underpinnings of feelings of social pain discussed in previous literature, as well as identify some potential reasons for their possible evolution, and discuss various neuroimaging techniques that could be used for future studies. Eisenberger suggests that the experience of social pain may be critical in sustaining close relationships meaningful to survival, like the mother-infant relationship. Eisenberger (2006, p. 275) also suggests that mammals probably share similar neural underpinnings that respond to social pain because mammalian infants are unique in that they need "prolonged attention from a caregiver." Consequently, it is theorized that the neural system responsible for responding to social pain and social attachment may have "piggy-backed" on the neural circuits responsible for responding to physical pain, in order to ensure the survival of these dependent mammalian species. The neural circuitry involved in the feelings of social pain may also participate in the behavioral responses responsible for reestablishing social connection, like infant crying

Hawkley and Cacioppo (2010) reviewed the consequences of loneliness, as well as the biological mechanisms in place when one is faced with the perception of loneliness. They propose that loneliness possesses similar mechanisms to physical pain or distress, in that it motivates humans to fix the problem (i.e. when animals feel hunger, they eat). They hypothesize that loneliness motivates humans, and has motivated humans throughout mankind's past, to create and maintain social bonds which ensures the survival and succession of human genes by increasing their odds of survival and reproduction. They conjecture that the perception of loneliness, or social isolation, causes humans to feel unsafe which then causes a response of hyper-vigilance for any additional threats to their social-connectedness. Hawkley and Cacioppo go on to claim that loneliness has positive correlations with high blood pressure and greater risk of cardiovascular distress such as heart disease. They also cite studies that suggest positive

correlations between loneliness and various psychological disorders such as depression, personality disorders, increased risk of Alzheimer's disease, perceived stress, anxiety, and diminished optimism and self-esteem. They posit that this link between a perceived lack of social-connectedness and lower feelings of optimism and self-esteem demonstrates that social bonds provide a foundation to build one's sense of self upon, and damaging that foundation, consequently damages one's sense of self. However, despite having mechanisms in place to respond to the perception of social isolation, Hawkley and Cacioppo found that people experiencing loneliness tend to develop negative expectations, causing a self-fulfilling prophecy of sorts that causes them to behave in such a way that isolates them further, such as avoiding people out of fear of further social pain. As previously mentioned in Eisenberger, Lieberman, and Williams (2003), Hawkley and Cacioppo (2010) did notice that loneliness affects people's ability to self-regulate their thoughts, feelings, and emotions, like the distress of rejection previously mentioned. Additionally, attentional processes requiring conscious thought and effort, as opposed to subconscious tasks, were diminished in their effectiveness compared to people that perceived themselves as socially connected. The ability to regulate thoughts, emotions, and behavior strengthens itself, meaning that the ability to regulate one's emotions in turn strengthens the ability to regulate other self-control behaviors, such as motivating oneself to exercise. Hawkley and Cacioppo close by saying that humans' social behaviors may be rooted in the evolutionary past of humanity, where social connections meant greater success in survival and reproduction, and that understanding this past can help humans to create a reasonable response to loneliness by keeping this in mind.

Conclusion

According to Hawkley and Cacioppo (2010), loneliness is quite common, with up to 80% of those under the age of 18 and 40% of adults over the age of 65 claiming to experience it at least sometimes. With an experience as common as this, it is important to properly understand any and all underlying causes or factors in order to formulate an appropriate treatment. Regarding loneliness as an experience meant to assist humans in survival, the same way hunger alerts organisms to their need to eat, may help humans regard loneliness, not as a personal short-coming, but as a helpful biological mechanism meant to motivate them towards social resolution.

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Appendix A

UCLA Loneliness Scale (as cited by Hawkley and Cacioppo, 2010)

TABLE 1
UCLA Loneliness Scale (Version 3)

Instructions: The following statements describe how people sometimes feel. For each statement, please indicate how often you feel the way described by writing a number in the space provided. Here is an example:

How often do you feel happy?

If you never felt happy, you would respond "never"; if you always feel happy, you would respond "always."

NEVER	RARELY	SOMETIMES	ALWAYS
1	2	3	4

*1.	How often do you feel that you are "in tune" with the people around you?	_____
2.	How often do you feel that you lack companionship?	_____
3.	How often do you feel that there is no one you can turn to?	_____
4.	How often do you feel alone?	_____
*5.	How often do you feel part of a group of friends?	_____
*6.	How often do you feel that you have a lot in common with the people around you?	_____
7.	How often do you feel that you are no longer close to anyone?	_____
8.	How often do you feel that your interests and ideas are not shared by those around you?	_____
*9.	How often do you feel outgoing and friendly?	_____
*10.	How often do you feel close to people?	_____
11.	How often do you feel left out?	_____
12.	How often do you feel that your relationships with others are not meaningful?	_____
13.	How often do you feel that no one really knows you well?	_____
14.	How often do you feel isolated from others?	_____
*15.	How often do you feel you can find companionship when you want it?	_____
*16.	How often do you feel that there are people who really understand you?	_____
17.	How often do you feel shy?	_____
18.	How often do you feel that people are around you but not with you?	_____
*19.	How often do you feel that there are people you can talk to?	_____
*20.	How often do you feel that there are people you can turn to?	_____

Scoring:
Items that are asterisked should be reversed (i.e., 1 = 4, 2 = 3, 3 = 2, 4 = 1), and the scores for each item then summed together. Higher scores indicate greater degrees of loneliness.

Note.

Appendix B

Scatterplots Showing Connection between Self-Reported Distress and Brain Activity (A & B) and ACC and RVPFC Activity (C)