

*Boredom and Mental Pain*

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In recent years, there has been a large increase in research into the phenomenon of *boredom*. A literature search revealed that over 300 articles listing “boredom” as a key word have been published just since 2015. One can imagine that interest in the topic of boredom has only increased as a consequence of the social restrictions imposed by the current pandemic. Much of the research has focused on determining the conditions that elicit boredom in laboratory tasks; these include tasks that are either too demanding or not demanding enough, and/or tasks that lack any meaningful goal. Some theories suggest that boredom may serve an adaptive purpose, selected for by evolution, in that the feeling of boredom motivates individuals to seek meaningful and productive activities (Bench & Lench, 2013).

The one aspect of boredom that is universally agreed upon is that it is unpleasant and associated with negative affect. In fact, boredom is often described as mildly painful. The association between boredom and pain was illustrated well in a multi-study article published in the journal *Science* by Tim Wilson and his collaborators (Wilson et al., 2014). The individual study that drew the most public reaction was the one in which participants were asked to entertain themselves only by thinking for 15 minutes, after being deprived of other means of distraction. During this period, they were given the opportunity to deliver electric shocks to themselves, if they so desired. Of the participants who, in a previous phase of the experiment, reported that they would pay not to receive those same shocks, two-thirds of the males and a quarter of the females gave themselves at least one shock during the 15-minute thinking period. Other studies reported in this article confirmed that participants generally found the activity of just thinking to be unpleasant, and other researchers have replicated these findings (Nederkoorn, Vancleef, Wilkenhöner, Claes, & Havermans, 2016). It is important to note that research on individual differences has shown that some people are much more likely to experience boredom in various situations; several boredom proneness scales have been

developed in recent years (Vodanovich & Watt, 2015).

A good deal of research has shown that pain that can be controlled by the participant is less aversive than uncontrollable pain (e.g., Brascher, Becker, Hoeppli, & Schweinhardt, 2016). Therefore, a reasonable explanation for the self-administration of electric shocks when bored is that boredom itself is painful, and that the controlled pain of the shocks serves as a less unpleasant, and therefore preferable, experience – i.e., a welcome distraction. Understandably, given its highly subjective and variable nature, there has been little focus on understanding the origins of the painful component of boredom. In fact, it is not even clear whether the use of the term pain in connection with boredom is metaphorical or literal. In this paper, I will argue that there is a literal (physiological) connection between physical pain (e.g., the feeling that accompanies stubbing one's toe), and what appears to be the purely *mental pain* that accompanies boredom.

Cases of congenital indifference to pain make it clear that the aversive (suffering) aspect of pain arises from a secondary cortical reaction to afferent stimulation originating in the body's various pain receptors. Brain-scanning studies have shown that the cortical activity underlying the unpleasantness of physical pain (its affective component) involves neural signals sent from the dorsal anterior region of the cingulate cortex (dACC) to certain medial areas of the prefrontal cortex (Jahn, Nee, Alexander, & Brown, 2016). This can explain why cingulotomy, which interrupts the pathway just mentioned, can greatly relieve even severe chronic pain. This phenomenon of pain dissociation can also occur temporarily while one inhales nitrous oxide (N<sub>2</sub>O). I have experienced this strange feeling of indifference to pain while inhaling N<sub>2</sub>O during a dental procedure. The point I am leading to is that if the physical sensations normally associated with pain (its sensory component) can occur without the cortical activity that produces the affective component, it is not far-fetched to imagine that cortical pain activity can occur in the absence of noticeable or localizable physical pain. Indeed, it is parsimonious to posit that the experience we commonly refer to as mental pain arises from the same cortical activity that is responsible for the affective component of physical pain, but in the absence of an identifiable sensory pain component.

Studies have shown that social rejection can produce mental pain, and that it can be somewhat relieved by acetaminophen or marijuana (both target cannabinoid receptors). A particularly intense form of mental pain can be produced by a recent romantic rejection. One fMRI study found a good deal of overlap between the brain activity produced by physical pain, and that produced by observing a photo of the romantic partner who rejected the participant (Kross, Berman, Mischel, Smith, & Wager, 2011). However, the case of boredom suggests another avenue by which mental pain can arise. I propose that prolonged psychological stress can result in chronic muscle tension, as well as afferent stimulation from various visceral ar-

eas, that are capable of evoking a relatively mild cortical pain reaction even though none of the sensations is strong enough to be distinct or localizable. The feeling produced in this way would be felt as a vague discomfort that one would rather avoid, an “itch” that would motivate one to seek some form of distraction. Unaware of its ultimate bodily origin, we call this feeling boredom. A more intense level of this stimulation can produce the somatic symptoms of anxiety or depression.

These uncomfortable bodily feelings likely vary a good deal in intensity from person to person, and thus contribute to the variation in boredom proneness within the population. These feelings are also likely to vary somewhat over time within an individual, but I propose that the average intensity of these feelings is relatively stable for each person, and related to the personality trait of *neuroticism*. However, whether boredom is actually experienced at any given time, and how intensely, depends largely on the efficiency with which a person can generate distractions that can keep the discomfort out of awareness. From the viewpoint of the spotlight model of consciousness, activities and perceptions that dominate the area within the spotlight will keep the potentially uncomfortable feelings in the background, so that they produce little if any experience of unpleasantness. The three major forms of distraction that can push discomfort out of awareness correspond to three distinct modes of brain function: a) engaging in mental or motor tasks (task mode); b) paying attention to sensory input (sensory intake mode); and c) internally generating thoughts and images (default mode). For example, studies have shown that intense cognitive activity (task mode) can reduce pain (Valet et al., 2004), and maintaining an accepting attitude towards one’s pain (sensory intake mode) can reduce it, as well (Gard et al., 2012).

The default mode is more automatic than the other two modes. The brain activity that underlies this mode is driven by what has been termed the default-mode network (DMN), consisting mainly of the posterior cingulate and precuneus cortices and the areas of the medial prefrontal cortex to which they are connected. The DMN was discovered by analyzing fMRI data produced when participants were asked merely to rest in the scanner, and it was found to consume a good deal of energy in maintaining its high level of activity (Raichle & Snyder, 2007). The areas of the DMN are also activated when a participant is asked to recall personal memories or make social judgments. Although it has been theorized that the DMN serves the function of practicing one’s social skills, I am proposing that, given no other means of distraction, the DMN is activated automatically to reduce the pain of boredom; that reduction serves to reinforce the DMN response.

In sum, the potentially aversive feelings that produce the mental pain of boredom are always in the fringes of consciousness, and move into the spotlight when no other brain activity is being significantly stimulated by any task, or goal-seeking behavior. Indeed, if one is not

very engaged in a task, some boredom will be felt, which may stimulate the DMN to generate what are called task-unrelated thoughts (Murray, Krasich, Schooler, & Seli, 2020). An extended stream of such thoughts is referred to as mind wandering, another popular topic of research in recent years (Wang et al., 2018). Because of its pain-reducing effect, it is common for people to become highly addicted to whatever means of distraction they find to be most effective. If you assume that negative background feelings are a nearly universal human phenomenon, and that societal stress is only increasing over the years, it becomes easier to understand why addictions to social media, overeating, and many other obsessions are so common, especially in modern societies. Most often, boredom is only mildly uncomfortable, but it can nonetheless provoke reckless behavior, especially in teenagers, whose impulse control is not fully developed.

The question remains as to why prolonged stress, resulting in uncomfortably high levels of chronic tension, is so common in the human population. The problem may well begin during the unusually long period (compared to other mammals) of total helplessness endured by the human infant, when it is unlikely to get all of its needs met in a timely fashion. In fact, the infant may have already been bathed in its mother's stress hormones in the womb, as stress is passed epigenetically from one generation to the next (Bolten et al., 2011). Anyone who doesn't believe that boredom already occurs quite readily in toddlers has not interacted with them very much.

My conclusion is that boredom, as common as it is, is not a natural state programmed by evolution to serve an important purpose, but rather the result of an evolutionary flaw that results in prolonged stress at a stage of development when humans are least equipped to regulate it. However, there are ways that all humans, as they gain some maturity, can deal with and ultimately reduce the root cause of boredom by facing it directly through attention-directing methods, such as meditation (Zeidan et al., 2016).

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