

Boredom, Performance & Health

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Most people are bored sometimes, and the stereotype of a bored person is one of lethargy and amotivation. In stark contrast to this, world-class cyclist Mathieu van der Poel has been quoted with lining up to a bike race precisely because he was bored (Long, 2022). This begs the question of what being bored actually means, what it does, and whether it matters. In recent years, a growing body of research has addressed these questions. From this work, it has become clear that boredom plays a crucial role for performance and health. In fact, boredom can have drastic consequences in each domain. To illustrate this with a case most readers are familiar with, take the example of a long monotonous car drive: Being bored while driving not only impairs performance but also poses a threat to one's health, as it has been associated with higher rates of accidents on the road (Park, 2011). Importantly, boredom is not only relevant for performance and health as a transient state (the bored driver who gets injured in the crash), but also as a more stable trait (a person who is frequently bored and referred to as being *boredom prone*; Tam et al., 2021). The recent surge of interest in boredom notwithstanding, boredom research is still in its infancy, and more research is needed. With this Editorial, we want to further facilitate boredom research with respect to performance enhancement and health¹.

What is boredom?

To acknowledge why boredom matters, it is important to first define what boredom actually is. We define boredom as a state where a persons' mental or physical functions are not utilized adequately (Wolff, Radtke, et al., 2022). This implies that we get bored when we feel that we are not putting our time and/or resources to good use. This state of inadequate function utilization is assumed to occur when the current activity does not align with one's preferences, capabilities, and current energy levels.

¹ Most illustrative examples in this Editorial come from the world of cycling, as the lead author is a huge cycling fan and has mined the internet together with his cycling friends for illustrative quotes. Naturally, the mechanisms by which boredom occurs and operates are not confined to cycling.

This can be illustrated by the example of a cyclist who gets bored during a moderate intensity ride during a long stage at a bike race. The cyclist might prefer to ride faster, have the capabilities to do so, and she might feel sufficiently energized to ride faster. Here, the moderate intensity ride would neither align with her preferences, her capability, nor her available energy, making it more likely that she feels she is not putting her functions to good use.

What does boredom do?

Importantly, boredom is a consequential sensation: Boredom is understood to signal that what one is currently doing is not a good use of one's resources and that one should rather do something else. To put it in more technical terms, boredom is conceived to be a driver for exploration which seems to be triggered in situations where prediction error has been minimized and entropy is low (Seiler, et al., 2022; Wolff, Radtke et al., 2022). For the rider, this means that boredom should trigger the urge to do something else, such as riding faster or stopping the ride. Interestingly, both responses to boredom have been reported in the context of sports and exercise. With respect to the former, Quinn Simmons, a professional cyclist, has stated that he had to learn to tolerate boredom during races in order to conserve his energy, and not engage in futile attacks: "As hard as it is for me to sit in the bunch bored all day, it pays off, I think" (Barry, 2023). Regarding the latter, boredom is a frequently stated reason for why people refrain from physical exercise, and high boredom proneness has been linked to low physical activity levels (Wolff et al., 2021).

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As these examples highlight, boredom seems to function as a trigger to search for any alternative to what one is currently doing. Thus, boredom can be understood as an impartial motivator to do *something else*. And doing something else can lead to adaptive or maladaptive behavior. This assumed impartiality is supported by research showing that athletes who score high on a measure of boredom proneness make worse decisions in their sports (Wolff, Bieleke, et al., 2022). In this context, this was reflected in athletes' self-reports of acting too passively, but also too audaciously in their sports. Thus, boredom prone athletes were not biased towards one specific decision error (e.g., taking too many risks) but rather reported to make any type of suboptimal choice more frequently. This is consistent with a large body of research showing that high boredom proneness reflects a maladaptive self-regulatory style because boredom prone people tend to experience their life as boring in general and fail to adequately respond to their boredom (Tam et al., 2021).

As the prior examples from the sports context indicate, boredom can affect performance. Indeed, recent work shows that boredom predicts competition crises in ultra-endurance competitors, is associated

with impaired performance of elite and sub-elite athletes, and is higher when athletes perceive their training sessions to be lacking in value (for a review of the literature, please see Wolff et al., 2023). Outside the sports context, research from educational psychology provides ample evidence for the detrimental effects boredom can have on students' performance in school (for a review of the literature on academic boredom, please see (Goetz et al., under review). Attesting to the central role boredom plays in school contexts, students experience about half of the time in class as boring (e.g., Goetz et al., 2015), and higher levels of boredom are associated with lower achievement (Camacho-Morles et al., 2021). Further work has focused on boredom's effect on performance in the workplace (for a review of the most recent literature, please see van Hooft & van Hooft, under review). Importantly, boredom has not only been identified as critical to job satisfaction and turnover, but it also matters for work performance (e.g., Loukidou et al., 2009). This is especially relevant in fields where minor drops in performance can have fatal consequences, such as the nuclear industry or aviation (Caldwell et al., 2019), boredom has been identified as a critical ingredient to "pilot fatigue" (Wikipedia, 2023), and there is even (anecdotal) evidence for boredom-induced plane crashes.

Boredom and Health

Beyond performance, boredom is relevant for health too. State boredom has been identified as a reason for excessive drug use or harming oneself (Sharp et al., 2011) or others (Pfafftheicher et al., 2021). Moreover, some people refrain from doing sports because it is boring to them. However, some people also do sports or do more and different type of sports, to escape the boredom they might experience in other contexts. World class triathlete David McNamee, for example got into triathlon because he was "a bored swimmer" (Tassell, 2022). Thus, similar to performance, the link between state boredom and health seems to be a nuanced one. In contrast, boredom proneness seems to be rather consistently associated with negative health outcomes. To illustrate, boredom proneness is linked to various clinical conditions, and particularly robust links have been found with depression and to traumatic brain injury (Goldberg & Danckert, 2013). Conceptually, it is particularly intriguing to consider this link between boredom proneness and conditions that affect the structural and functional integrity of brain networks responsible for integrating information about rewards in the environment. This suggests that boredom proneness might reflect a generalized lower valuation of available activities, which makes it harder for boredom prone people to find activities that are worthwhile engaging in (Danckert & Elpidorou, 2023). This lower valuation might be particularly relevant when it comes to the efforts that tend to be required for various health-promoting activities. Consistent with this, research shows that boredom prone people engage in unhealthy activities more frequently and in healthy activities less frequently. This is illustrated by an increased likelihood to engage in behaviors, such as drug taking, alcohol consumption, or poor nutrition, and a lower rate of engaging in healthy behaviors, such as exercise, self-

care, or adhering to potentially lifesaving social distancing guidelines during the COVID-19 pandemic (Bieleke et al., 2022).

Two Concluding Remarks

Throughout this Editorial, we have made the case for why boredom is a crucial sensation that guides human behavior, and we have illustrated the effects boredom can have on performance and health. We will close this Editorial by emphasizing that boredom is still misunderstood and overlooked. In order to truly understand boredom's role with respect to performance and health, a better understanding of and accounting for boredom is needed.

First, boredom is still misunderstood: Here, we have made the case that boredom is an impartial signal for change, which does not cause people to do exclusively bad or good things. Yet, some responses to boredom might be more accessible than others, because they are more salient and/or require less effort. Responses such as scrolling through social media, consuming illicit drugs, or alcohol consumption provide highly accessible and rapid escapes from boredom, and they require less effort than activities such as physical exercise or studying for an exam. This might be especially true for boredom prone people. Consistent with this, the majority of studies associates boredom with impaired performance and health, painting a rather gloomy picture of boredom. However, we would like to stress that this negative empirical picture of boredom is likely biased: Most research (and anecdotal evidence) investigates boredom when it has already manifested itself and when people affectively and behaviorally respond to this. However, within the framework of boredom we present here (and discuss elsewhere in depth, Wolff, Radtke, et al., 2022), boredom is frequently guiding our behavioral choices efficiently and quietly: We tend to seek out jobs, relationships, and hobbies that are not boring, and we tend to move on from them before excessive boredom manifests itself. From this point of view, the known association between boredom and bad things possibly reflects outliers for when an efficient and fast response to boredom was not possible (for internal or external reasons). Very indirect evidence for this claim comes from Google Search Trends at the beginning of the COVID-19 pandemic (Figure 1). When social distancing guidelines were imposed, boredom spiked as a search term. Importantly, this rapidly normalized to pre-pandemic levels, and one might think that (most) people had quickly found effective ways to not be bored in this new situation. To better understand boredom, we believe it is important to take a comprehensive perspective on this sensation that is conscious to the idea that we might not actively realize the many instances where boredom effectively guides our behavior.

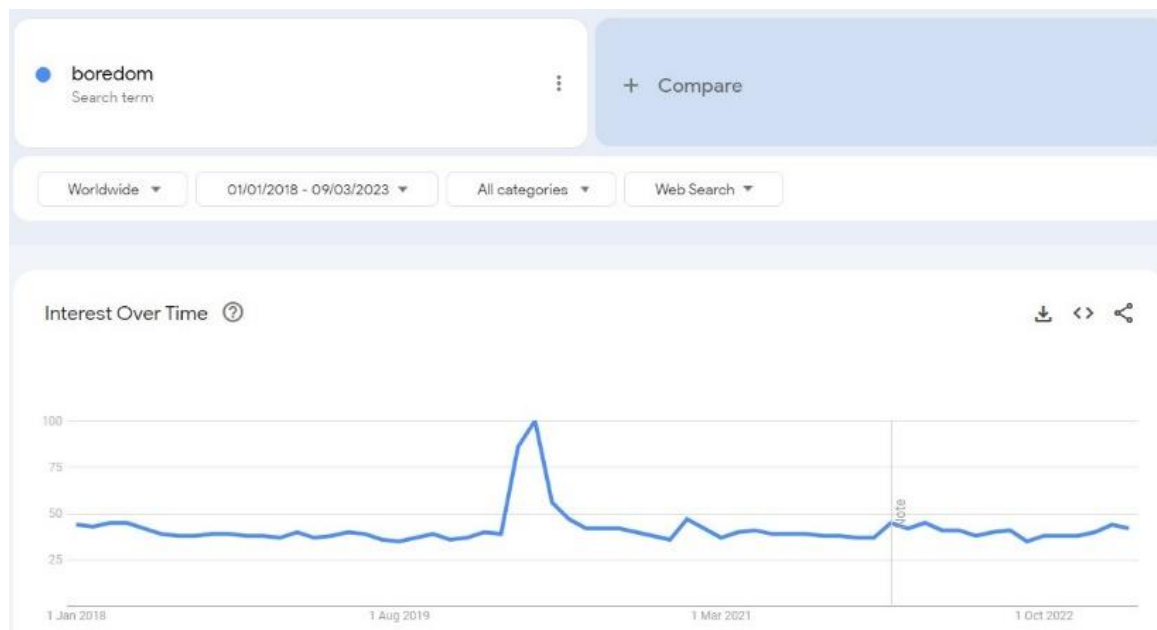


Figure 1. Worldwide interest in "boredom" as a search term on Google. Interest in Boredom doubled in spring 2020, coinciding with the time many countries employed behavioral restriction, such as lockdowns. Interestingly, interest in boredom normalized very quickly back to pre-pandemic levels.

Second, boredom is still overlooked: Although dedicated research on boredom is booming, boredom is very much neglected as a potential confound in research. But why could boredom be a confound? To measure different facets of human performance and health, researchers often have participants complete standardized cognitive or physical tests and questionnaires. Such measures are optimized to tap into the construct of interest as good as possible. To achieve this, procedures can be highly standardized (e.g., lengthy written instructions for tasks that have to be completed alone on a computer), participants' degrees of freedom can be restricted (e.g., in a resistance training workout, where intensity, duration, and rest periods are exactly predetermined), and myriads of trials and survey questions can be presented (e.g., hundreds of trials that are used in a computerized sustained attention task). In a recent data-supported comment with two samples of frequently studied populations (university students and paid online workers), we have made the case that these efforts might have the unwanted consequence of boring participants (Meier et al., 2023). More importantly, if participants get bored when participating in a study, this might affect their behavior during the study and ultimately skew results. Thus, research protocols that bore participants might introduce boredom as an unwanted confound and participants believe that their boredom alters study outcomes. This is particularly problematic if experimental conditions differ in their "boringness", if the boredom changes over time, and if participants differ a priori with respect to boredom proneness. To better account for boredom as a potential confound, it would be promising to control for inter-individual differences in boredom proneness, to track boredom during tasks and across conditions, as well as asking participants if they were bored during the study.

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