

# Boredom and Cognitive Engagement:

## A Functional Theory of Boredom

Andreas Elpidorou

Department of Philosophy  
University of Louisville

**Abstract.** The functional theory of boredom maintains that boredom ought to be defined in terms of its role in our mental and behavioral economy. Although the functional theory has recently received considerable attention, presentations of this theory have not specified with sufficient precision either its commitments or its consequences for the ontology of boredom. This essay offers an in-depth examination of the functional theory. It explains what boredom is according to the functional view; it shows how the functional theory can account for the known characteristics of boredom; and it articulates the theory's basic commitments, virtues, and limitations. Ultimately, by furthering our understanding of the functional theory of boredom, the essay contributes to a better theoretical grounding of boredom.

**Keywords:** boredom; emotions; function; affect; self-regulation; frustration; cognitive engagement; attention; effort

**Accepted for publication. This is the uncorrected, penultimate version of a paper that will appear in *Review of Philosophy and Psychology*.**

<https://www.springer.com/journal/13164>

# **Boredom and Cognitive Engagement:**

## **A Functional Theory of Boredom**

### **1. INTRODUCTION**

There is no shortage of theories of boredom. If anything, there is an embarrassment of riches. In the literature one finds at least five distinct theoretical articulations of the nature of boredom. First, there is the psychodynamic theory of boredom which understands boredom to be the result of an unfulfilled desire<sup>1</sup> (Fenichel, 1953; Greenson, 1953; Lewinsky, 1943). Second, there is the existential theory of boredom that maintains that boredom is a state of perceived meaninglessness, a response to the perception of meaninglessness, or both (Frankl, 1984; Maddi, 1970; Van Tilburg & Igou, 2011, 2012). Third, the arousal theory considers boredom to be a state of non-optimal arousal (Berlyne, 1960; Csikszentmihalyi, 1975; De Chenne, 1988; Hebb, 1966; O’Hanlon, 1981; Zuckerman, 1979). Fourth, the cognitive theory of boredom understands boredom to be the result of one’s difficulty or inability to cognitively engage with an object. The most influential variety of the cognitive theory maintains that boredom is inextricably bound to attentional difficulties or to the misallocation of attention (Eastwood et al., 2012; Fisher, 1993; Hamilton, 1981; Harris, 2000; Hill and Perkins, 1985; Tam et al., 2021). Other varieties of this view implicate non-optimal subjective control or non-optimal effort as reasons for lack of cognitive engagement (Csikszentmihalyi, 1975; cf. Pekrun et al., 2010). Lastly, there is the functional account that conceives of boredom as a functional state—i.e., a state which is defined in terms of its role in the mental economy of the experiencing agent (Bench and Lench, 2013; Danckert, 2019; Danckert, Mugon, et al., 2018; Elpidorou, 2014, 2016, 2018a, 2018b; Kurzban et al., 2013; Van Tilburg & Igou, 2012). In

addition, to these five characterizations there are also mixed views of boredom: i.e., views that combine into a single theory both cognitive and existential characterizations of boredom. For example, the MAC Model of Boredom holds that boredom arises either because one cannot find meaning in one's activities or because one is not able to pay attention to one's situation (Westgate & Wilson, 2018), whereas the Control-Value Theory of achievement emotions conceives of boredom as an emotional state that arises when there is perceived lack of value and non-optimal control (Pekrun et al., 2010). It is not entirely clear whether such views occupy distinct theoretical positions or whether they should be subsumed under one of the five aforementioned theories of boredom.<sup>2</sup> Regardless of how one settles that issue, it is evident that the boredom literature contains different answers to the question *what is boredom?*

Although theories of boredom often draw from the same pool of experimental findings, they offer diverging descriptions of the phenomenon at hand. Ultimately, they disagree as to what boredom is most fundamentally. Is it at heart a volitional, physiological, affective, or cognitive phenomenon? Or is it something else entirely? But even when two theories agree about the type of phenomenon that boredom is, they may still disagree regarding its specific nature. For instance, both the existential theory and the (attentional) cognitive theory of boredom understand boredom to be primarily a cognitive phenomenon, even though they explicate it in different ways: one emphasizes perceived meaninglessness in the experience of boredom, whereas the other underlines the role of attentional difficulties. Lastly, theoretical descriptions of boredom do not always make explicit whether what they isolate as the core of boredom (attentional difficulties, non-optimal arousal, perceived meaninglessness, etc.) is an antecedent of boredom, a proper part of boredom, or both. Despite our experimental and theoretical riches, it is clear that important questions about boredom remain unanswered.

The current essay aims to present and assess one of the available theories of boredom: the functional theory. Although this theory has recently received considerable attention both within psychology and philosophy, presentations of the theory have not specified with sufficient precision either its commitments or its consequences for the ontology of boredom. This is primarily because extant presentations of this theory have had different aims: some of them were exploratory, investigating the possibility that boredom is a functional emotion (Bench & Lench, 2013; Elpidorou, 2014, 2016; Van Tilburg & Igou, 2012); others explored the consequences of a functional account for behavior and self-regulation (Van Tilburg & Igou 2011, 2017a; Elpidorou 2018a, 2018b, 2020; Danckert, Mugon, et al., 2018); and others used the functional account as a way of exploring novel approaches to boredom and its relationship to goal pursuit (Bench & Lench, 2013), effort (Kurzban et al., 2013), or arousal (Elpidorou 2021). Given the growing interest in the functional view of boredom, the time is right to take a closer view at the basic premises of the functional theory. This essay offers an in-depth examination of the functional theory. It explains in what sense it is a theory of boredom and what boredom is according to this theory; it shows how the functional theory can account for the known characteristics of boredom; and it articulates its basic theoretical commitments, benefits, and limitations. It also defends a specific variety of the functional view according to which boredom signals the presence of unsatisfactory cognitive engagement and aims to restore satisfactory cognitive engagement. By seeking to further our understanding of the functional theory of boredom, the essay aims to contribute to a better theoretical grounding of boredom.

## **2. THE CHARACTER OF BOREDOM**

Most of us have little trouble both recognizing boredom and distinguishing it from other related emotions and affective states (Goldberg et al., 2011; Van Tilburg & Igou, 2012). As a transient psychological state, boredom is a common (Chin et al., 2017; Goetz et al., 2014; Smith & Page, 2015; The National Center on Addiction and Substance Abuse, 2003) aversive experience that signifies a failure to engage with one's environment in a desired manner despite one's motivation to do so (Danckert & Merrifield, 2016; Eastwood et al., 2012; Goldberg et al., 2011). Boredom is characterized by attentional difficulties, a perceived dissatisfaction with our current situation, and a felt desire to change our situation. It typically arises in situations that are perceived to be monotonous or lacking in novelty or meaning (Thackray et al. 1977; O'Brien, 2014; Van Tilburg & Igou, 2012), that fail to engage sufficiently or optimally our cognitive resources (Csikszentmihalyi, 1975), or that are low in perceived autonomy (Hooft & Hooft, 2018; cf. Fenichel 1953; Fisher, 1993).

### **2.1. Valence and Phenomenology**

Boredom appears to be unambiguously a psychological state of negative valence. It is phenomenologically an unpleasant experience (Harris, 2000; Hartocollis, 1972; Mikulas & Vodanovich, 1993; Pekrun et al., 2010; Todman, 2003; Vogel-Walcutt et al., 2012); it motivates withdrawal behaviour and involves a desire to escape from it (Berlyne, 1960; Fahlman et al., 2013; Fenichel, 1953; Fiske and Maddi, 1961; Greenson, 1953; Mikulas and Vodanovich, 1993; Pekrun et al., 2010; Todman, 2003; Van Tilburg and Igou, 2012); it is triggered by situations that are perceived as negatively valued (uninteresting, trite, meaningless, etc.) (Van Tilburg & Igou, 2012, 2017a); it leads to a negative appraisal of one's situation (Eastwood et al., 2012);

and its presence is judged by subjects to be incongruent to their wishes and valued goals (Van Tilburg & Igou, 2012).

Even though boredom's valence appears to be negative in all of the aforesaid senses, its valence has been chiefly understood in terms of its phenomenology. Yet discussions of the phenomenology of boredom often underappreciate the complexity of the experience of boredom. Boredom is indeed an unpleasurable experience, but its aversive character is neither uniform nor constant across situations and time. First, first-personal reports on the character of the experience of boredom reveal that boredom is often experienced as both an apathetic and agitated state (Goetz et al., 2014; Harris, 2000; Martin et al., 2006; Steinberger et al., 2016). Second, the subjective experience of boredom may differ depending on various endogenous or exogenous factors. (Van Hooft & van Hooff, 2018; Westgate, 2020; Westgate & Wilson, 2018). Third, boredom is an experience that unfolds in time and because of that, it may oscillate from a state of high arousal to one of low arousal, or vice versa (Eastwood et al., 2012; cf. Danckert, Mugon, et al., 2018; Elpidorou, 2018b, 2021). It has been suggested that boredom may often begin as a state of low arousal because initially subjects find themselves unable to engage with their situation (Mills & Christoff, 2018). However, bored subjects will typically make efforts to engage with their environment and such attempts for engagement can result in an increase in arousal, especially if they are unsuccessful.

Boredom is, thus, a phenomenologically rich state. But, of course, it is more than that, for it is not merely a sensation. Just like most emotions, boredom is a complex (i.e., multidimensional) construct (Sander et al., 2018). In addition to its phenomenological dimension, it has a cognitive dimension which consists of the associated thoughts, appraisals, and attentional mechanisms, along with its effects on our cognitive and perceptual processes. It also includes a volitional or motivational content that comprises of its associated desires and

action-tendencies. Lastly, it has an expressive component that includes its behavioral and physiological correlates. An adequate specification of the character of boredom requires a discussion of these additional dimensions of boredom.

## **2.2. Cognitive Profile**

The cognitive profile of boredom is characterized chiefly by two features: the presence of negative appraisals of one's situation and attentional difficulties (Eastwood et al., 2012; Tam, in press; Van Tilburg & Igou, 2017a). Either individually or jointly, these features appear to play a double role in the experience of boredom: they can be the antecedents of boredom, insofar as they precede and perhaps cause the experience of boredom, or they are the proper parts of the experience of boredom, insofar as any instance of the experience of boredom involves either one of these two features. What is more, these two features are related. If one appraises negatively one's situation, then it is likely that one will not be attentive to one's situation. Conversely, when a situation is incapable of capturing one's attention, one tends to appraise it negatively (Eastwood et al. 2012).

What does it mean to say that boredom involves the presence of negative appraisals of one's situation? Stated in broad terms, the answer is simple: bored individuals find their situations to be unsatisfactory. Of course, finding one's situation to be unsatisfactory may mean different things. As a result, the experience of boredom has been associated with the presence of a variety of negative appraisals. The most widely accepted view is that the negative appraisals that are either characteristic or the cause of boredom are ones that have to do primarily with a perceived lack of meaning. In other words, the experience of boredom is associated with the perception that one's situation is lacking in meaning. Evidence for this view comes from studies that have demonstrated a relationship between the presence of

boredom and perceived meaningfulness (Chan et al., 2018; Fahlman et al., 2009; Van Tilburg & Igou, 2011, 2017b).

Perceived meaningfulness is not the only negative appraisal that might be either present during boredom or a causal antecedent of boredom. It has been suggested that boredom is also related to appraisals that one's situation is lacking in relevance (Fahlman et al. 2013), that the situation is low in perceived autonomy (Caldwell et al., 1999; Martin et al., 2006; Shaw et al., 2006; Steinberger et al., 2016; van Hooft & van Hooff, 2018), and that it affords the individual non-optimal stimulation or challenge (either too stimulating or too challenging or not stimulating or challenging enough) (Csikszentmihalyi, 1975; Daschmann et al., 2011).

The second main feature of the cognitive profile of boredom has to do with the experience of attentional difficulties. It is a common theme in the boredom literature that boredom is a state associated with a difficulty in concentrating and maintaining attention (Ahmed 1990; Hamilton 1981; Hamilton et al. 1984; Damrad-Frye and Laird 1989; Eastwood et al. 2012; Gordon et al. 1997; Harris 2000; Wallace et al. 2003; Westgate & Wilson, 2018) and there have been theoretical attempts to show that attentional failure is the underlying mechanism of boredom (Eastwood et al. 2012; Tam et al., 2021). Support comes from findings that show that manipulation of attention can affect the experience of boredom (Damrad-Frye and Laird 1989), from studies that have linked lapses in attention to the experience of boredom (Carriere et al., 2008; Cheyne et al., 2006), and from the observation that tasks that require sustained attention, which are passive in nature, are often perceived as boring (Malkovsky et al. 2012; Pattyn et al. 2008; Scerbo et al. 1992). Furthermore, boredom is also experienced often by individuals with compromised attentional capacities (Oddy et al., 1978; Kreutzer et al., 2001; cf. Hunter and Eastwood 2018).



It is important to note that negative appraisals and attentional difficulties do not exhaust the cognitive features of the experience of boredom. Although they appear to be the most important cognitive characteristics of boredom, an altered perception of the passage of time has also been associated with the experience of boredom. (London & Monello, 1974; Watt 1991; Danckert & Allman 2005; Witowska et al., 2020). The perception of a slower passage of time can make oneself feel stuck in a situation and can thus intensify the aversive character of the experience of boredom.

### **2.3. Volitional Profile**

Boredom is essentially a state of discontent (O'Brien, 2014). As such, it is a state that is incongruous with our desires and goals and one from which we seek escape (Bench & Lench 2013). This description of boredom makes evident that boredom is not merely a cognitive or affective phenomenon but also a volitional one. Even the widely accepted characterization of boredom as “an aversive experience of *wanting*, but being unable, to engage in satisfying activity” underlines its volitional character (Eastwood et al., 2012; emphasis added). Boredom involves essentially a desire to do something other than what one is currently doing (Fahlman et al., 2013).

The volitional content of boredom is thus characterized by the presence of a strong desire to alleviate one's experience of boredom by engaging in an alternative task or situation. The volitional character of boredom is key in properly understanding its nature and outcomes. First, the presence of a desire to escape our unsatisfactory situation accounts for the distinction between boredom and apathy (Goldberg et al., 2011; Nisbet 1982): apathy, but not boredom, is characterized by motivational loss. Second, the desire to escape our situation and to alleviate boredom, decouples us from our current situation and prepares us for action. Such a desire

for escape is often successful in moving us out of our boring situation. What is especially noteworthy is the fact that boredom's volitional and motivational component is so strong that in our attempt to escape boredom we may even find recourse in activities that are dangerous and harmful to us and to others (Bench and Lench, 2019; Elpidorou, 2020; Nederkoorn et al., 2016; Pfattheicher et al. 2020; Wilson et al., 2014).

It has been argued that what motivates one's attempt to escape a boring situation is a desire to reestablish a perception of meaningfulness (Van Tilburg and Igou, 2011, 2012, 2016, 2017b; Van Tilburg et al., 2013). Boredom, according to this view, is both a crisis of meaning (a state of perceived meaninglessness) and an attempt to recover lost meaning. However, meaning does not have to be the sole driving mechanism. It is possible that one seeks novelty, excitement, or a thrill without necessarily conceiving of those features as primarily meaningful (Bench & Lench, 2019). Alternatively, what might motivate one's behavior in the face of boredom could be a desire to alleviate the aversive experience that is the outcome of mental representations of opportunity costs and benefits associated with the performance of a boring task (Kurzban et al., 2013). According to this account, boring tasks are costly (in terms of the psychological or computational mechanisms needed to engage with them) and less rewarding than other available tasks. For recent evidence in support of the relevance of the opportunity costs model in the case of boredom, see Boylan et al. (2021), Struk et al. (2020), and Wolff et al. (2020).

The volitional content of boredom is what we might call "thin." That is to say, although bored individuals experience a strong desire to cease doing what they are currently doing and to engage in an alternative course of action, they do not always know what they wish to do (Fahlman et al. 2013). In this sense, the volitional content of boredom appears to be best understood as the imperative "Do something else!" without however specifying what

that something else is exactly. This feature of boredom can offer an explanation as to why boredom has been implicated in both beneficial and harmful behaviors (Bench & Lench, 2019; Elpidorou 2018a, 2020; Pfattheicher et al. 2020; Van Tilburg & Igou, 2017b), why bored individuals might be at a loss when it comes to finding ways to counter the effects of the experience of boredom (Bargdill, 2000; Bernstein, 1975; Greenson, 1953; Martin et al., 2006), and why the experience of boredom appears to involve a disrupted sense of agency (Danckert & Eastwood, 2020; Eastwood et al. 2012).

#### **2.4. Physiological and Expressive Profile**

Boredom is also partly characterized by its physiological and neurological correlates and by its motor and expressive features. Regarding the physiological correlates of boredom, available findings suggest that boredom is a state of low, high, or even mixed arousal. All three proposals have been defended in the literature (for a review, see Elpidorou 2021). Here, there is no need to settle the character of boredom's physiological arousal. What matters is that boredom, through its physiological concomitants, can facilitate the pursuit of alternative situations, either by deactivating us (low arousal) and thus disengaging us from our current situation or by activating us (high arousal) and thus preparing us for movement, action, and change.

In terms of its neurological correlates, investigations utilizing electroencephalography (EEG) revealed that the presence of boredom is associated with reduced EEG power in distinct frequency bands. A study by Tabatabaie and colleagues (2014) found that boredom was correlated with lower beta activity in the left dorsolateral prefrontal cortex (Tabatabaie et al., 2014), a possible sign of attentional difficulties. A different study by Katahira and colleagues (2018) reported that, compared to both a flow and overload condition, boredom was related to lower levels of frontal theta power—a result that suggests less cognitive control

during boredom. An older study found boredom to be correlated with the presence of alpha waves (a likely indication of wakeful relaxation or mental inactivity) (Oswald, 1962; see also Raffaelli, Mills, & Christoff, 2018). In more recent work, Perone, Anderson and Weybright (2020) found that the theta/beta ratio was lower during an easy (boring) condition compared to an optimal condition and interpreted this finding to mean that compared to the optimal condition, subjects experienced difficulties maintaining their attention. Perone and colleagues also measured frontal alpha asymmetry, a measure of the presence of self-regulatory processes, and found that when the easy condition followed the optimal condition there was an increase in right frontal activity. Such a finding suggests the deployment of self-regulatory processes during the easy/boring condition (at least when the optimal condition preceded it). Lastly, Yakobi, Boylan, and Danckert (2021) examined the event-related potentials associated with the performance of a boring task. They reported reduced P3 and error-related negativity amplitudes in participants who experienced higher levels of task-induced boredom. Yakobi and colleagues interpret these findings as evidence that task-induced boredom is associated, on the one hand, with disruptions in working-memory updating (reduced P3 amplitudes), and, on the other hand, with reduced performance monitoring (reduced error-related negativity amplitudes) (see also Yakobi & Danckert, 2021 for EEG findings related to boredom proneness).

Brain imaging shows activation of components of the default mode network during the experience of boredom (Danckert & Merrifield, 2016; Dal Mas & Wittmann, 2017; Ulrich et al., 2014). Danckert and Merrifield (2016) reported that, compared to the resting state, boredom was associated with anticorrelated activity in the anterior insular cortex—a result that may indicate that during boredom one attempts to engage with the situation at hand. The study by Dal Mas and Wittmann found that insular activity increased with increasing amounts

of money that participants were willing to pay for a music download when they were bored. This reported upregulation of insular activity could be indicative of a desire to engage with something meaningful when bored (for further discussion, see Danckert, 2019).

Studies examining the motor components of boredom have shown that boredom typically involves the act of raising one's chin and leaning the head backwards, a collapse of the upper body, and lack of movement (Wallbott, 1998; see also Lhommet and Marsella, 2015). Bull (1987) adds that during boredom individuals often support their heads with one hand. Bored individuals do not move a lot. But when they do, they tend to make sudden movements (Kroes, 2005). Martin and colleagues' phenomenological investigation of boredom (Martin et al., 2006) lists fidgeting as a response to boredom. Investigations into the facial expressions of boredom have not given rise to conclusive results (see Craig et al., 2008; Kroes, 2005; Scherer and Ellgring, 2007). Lastly, studies have found that bored speech is slow and soft, has a low pitch, and exhibits a narrow pitch range (Johnstone & Scherer, 2000; Scherer, 2013).

### **3. THE FUNCTION OF BOREDOM**

#### **3.1. A theory of boredom**

The most important claim of the functional theory is that boredom is a functional emotion (or affective state).<sup>3</sup> What this claim amounts to is that boredom should be defined in terms of its function (Adolphs & Andler, 2018; Polger, 2012; Levin, 2018). Boredom is what it *does*. Or more precisely, boredom is the emotion that plays a specific role within our mental and behavioral economy such that anything that plays that role is boredom and any state that does not play that role cannot be boredom. This initial presentation of the functional view demands further elucidation.

First, a conception of boredom as a functional emotion is in line with a broader

theoretical view that conceives of most (if not all) emotions as functional (e.g., Carver & Scheier, 1990, 2013; Frijda, 1986; Frijda & Mesquita, 1994; Keltner & Gross, 1999; Keltner & Haidt, 1999; Levenson, 1994; Niedenthal & Brauer, 2012; Oatley & Jenkins, 1992; Plutchik, 2001; see also Cosmides & Tooby, 2000; Tooby & Cosmides, 2008). Often proponents of this broader view ascribe to emotions *teleological* functions and not just *minimal* functions. Whereas a minimal function is simply something that an entity does (or an effect that it has), a teleological function is what the entity does that explains its presence (Wright, 1973). There are different articulations of teleological functions (Neander, 2017), but the most common one—at least within the context of biological sciences—is an evolutionary one that holds that functions are grounded in natural selection. Applied to emotions, this view of teleological function gives rise to the claim that emotions are the products of evolution (either as adaptations or exaptations): they have evolved because of their adaptive functions and contributions to survival (Hasselton & Ketelaar, 2006; Keltner, Haidt, and Shiota, 2006). Although one can speculate about boredom’s evolutionary function (perhaps it arose as a way of safeguarding valuable psychological resources by promoting movement out of recurring situations in an ancestral environment that were not conducive to the organism’s goals), the issue of whether boredom possesses a teleological function and what that might be will be bracketed here.<sup>4</sup> One can give a functional theory of boredom without, at least initially, having to settle *how* or *why* its function came to be. For the present purposes, it is enough of a progress if we are able to state clearly *what* boredom does.

It is important to emphasize that although entailed by the theoretical position that all emotional states are functional states, the functional theory of boredom does not need to accept that all emotions are functional states. That is, one can accept that boredom is a functional state without also insisting that every emotion is the same. Theorists of boredom

do not have to commit to grand claims regarding the nature of emotions. After all, it might be the case that the category of emotion is not a natural kind and consequently, what holds true for one emotion type does not necessarily hold true for some other emotion type.

Second, the functional theory of boredom is not a characterization of some accidental feature of boredom. Boredom is not something (e.g., a biological state, cognitive process, or a phenomenological experience) that also happens to have the function that the functional theory assigns to it. Rather, boredom is essentially its function. Consequently, boredom's biology, its cognitive effects, the way it feels, etc., are features *of* boredom because they jointly contribute to the execution of its function. The functional theory assigns thus both an ontological and explanatory priority to the function of boredom.

Third, even when it is accepted that boredom ought to be defined in terms of its function, it is still an open question as to whether boredom should be identified with a *role* or with the *realizer* of the role (Levin, 2018). The distinction is important, but unfortunately often missed. On the one hand, if boredom is identified with a role, then boredom is a second-order relational property of an organism (or system): it is the property of having some other properties that meet certain conditions. Specifically, boredom is the property of having a set of features capable of jointly executing the function assigned to boredom. On the other hand, if boredom is identified instead with the realizer of its role, then it is the specific neurological state (or process) that is actually capable of exercising boredom's function in humans. An example may help to illustrate the distinction. Suppose that we simplistically define memory functionally as the ability to store and retrieve information. If memory is the functional role, then it becomes the second-order property of having some other properties (whatever those may be) that can store and retrieve information. However, if memory is the realizer of its functional role, then memory is the specific neurological process that stores and retrieves

information in humans.

The distinction between these two functional understandings carries important ramifications. If boredom is identified with a role, then the physiological details of what realizes the boredom role in humans are important in helping us to determine whether boredom is being instantiated. Still, they are not ontologically important in the sense that they do not suffice (on their own) to tell us what boredom is. To see why this is the case consider another example. Functionally understood, a chair is a structure that affords sitting. The material that a chair is made out of (metal, wood, marble, inflatable plastic, etc.) does not determine whether something is a chair. What determines if an object is a chair is whether that object was designed in order to fulfil its sitting-affording function. The same goes, *mutatis mutandis*, for boredom, if boredom is identified with a functional role.

Within emotion literature, functional views of emotions typically identify emotions with a role and not with the specific state that plays that role (Adolphs & Anderson, 2018, p. 40). A reason in support of this view stems from known difficulties in finding consistent correlations between emotional feelings, on the one hand, and physiological patterns or neurological activation, on the other hand (see Adolphs & Andler, 2018; Hoemann et al., 2020; Lindquist et al., 2018; Siegel et al., 2018). If different instances of an emotion, say, fear, are correlated at different times (or in different situations) with different patterns of physiological or neurological activation, then fear should not be identified with a specific physiological or neurological state, but with something else that explains why those observed patterns of physiological and neurological activation are elements of fear. Identifying fear with a functional role can do precisely that. In the case of boredom, empirical evidence shows that boredom is instantiated during both deactivating and activating patterns of physiological arousal (for a review, see Elpidorou, 2021). Thus, it is unlikely that there is one physiological state with which



boredom should be identified. In addition, it has been argued that animals, and not just humans, experience boredom (Burn, 2017; Meagher & Mason, 2012; Wemelsfelder, 1985, 1991, 2005). Such a contention offers further support for understanding boredom as a second-order property. If boredom is identified with a role (and not with a specific physiological state), then it can occur not only in humans but also in animals and even in machines. Because of these reasons, the functional view presented in this essay understands boredom to be a role (a second-order property) and not the realizer of the role.

### **3.2. Describing the function of boredom**

If boredom is defined in terms of its function—if it is, in other words, the second-order property of having properties capable of executing a specific function—then what is boredom’s function? Boredom serves essentially a regulatory function (Bench & Lench, 2013; Danckert, Mugon, et al., 2018; Elpidorou, 2014, 2018a, 2018b; Geana et al., 2016; Wolff & Martarelli, 2020). It signifies the presence of an unsatisfactory situation and motivates the emoting agent to seek escape from it. This first pass on the function of boredom does not fully capture the function of boredom but only approximates it. It is useful insofar as it allows us to grasp the general nature of boredom. At the same time, it lacks requisite specificity because it does not allow us to distinguish boredom from other related emotions. Consider for instance fear. It would seem that a functional account of fear would also assign to fear the two-fold function assigned to boredom. Fear, just like boredom, informs the experiencing agent of the presence of an unsatisfactory situation and motivates the agent to seek escape from it. To properly distinguish between boredom and other related emotions, one must specify in detail boredom’s function.

How then do we describe in sufficient detail the function of boredom? As a functional state, boredom is an interconnected cluster of characteristics (experiential, cognitive, volitional, physiological) that jointly give rise to either an attempted or realized transition from one psychological-behavioral state to another. Consequently, in our attempt to explicate the nature of boredom we need to offer an explanation of how this psychological and behavioral transition takes place. Specifically, the functional model ought to specify the following. (1) The input of boredom: the (typical) conditions under which boredom arises. (2) The output of boredom: the (typical) effects of boredom on our psychology and behaviour. (3) The input-output transition: the manner in which the different features of boredom (its affective, cognitive, volitional, and physiological characteristics) contribute to the execution of its function. Without an analysis of how the transition works, we do not really have an account of boredom, but just the rudiments of a behaviorist account.

## **Input**

There are different ways of proceeding when attempting to determine the antecedents of an emotion. One possible way is to try to articulate objective features of the environment that bear a conditional relationship to the experience of the emotion such that if an agent finds themselves in such-and-so conditions, then the agent would experience the emotion under question. In the case of boredom, studies have shown that situations that are repetitive (e.g., Daschmann et al., 2011; Ralph et al., 2017), uninteresting (Merrifield & Danckert, 2014), meaningless (Van Tilburg & Igou, 2012), or non-optimally challenging (Acee et al., 2010; Harris, 2000; Martin et al., 2006) tend to lead to the experience of boredom. Even though commonplace, this objective conditional approach does not seem very promising when it comes to boredom. That is primarily due to two interrelated reasons. First, there does not

appear to be a list of environmental conditions that would either invariably or even most of the time give rise to the state of boredom. Granted, monotony, constraint, or repetition often yield boredom (Fisher, 1993), but they are neither sufficient nor necessary conditions of the experience of boredom (Barbalet, 1999). Second, and more importantly, whether an environmental factor is likely to be an antecedent of boredom or not depends on how the agent appraises their situation (Eastwood et al., 2012; Martin et al., 2006; Mercer-Lynn et al., 2014; Fisher 1993). But appraisals of one's situations need not, and, as a matter of fact, do not necessarily track some objective feature of one's situation. For instance, repetitive or challenging situations lead to experience of boredom only in some and not in all subjects (Barbalet, 1999; Daniels et al., 2015; Wyatt et al., 1929). Such a conclusion regarding the antecedents of boredom is broadly consistent with an information-processing account of boredom (Klapp, 1986) which holds that boredom arises when our situation is such that affords the retrieval of either too much or too little information. On the one hand, monotonous and repetitive situations are often deemed to be boring because they are characterized by an informational redundancy: they offer very little new information and thus meaning. On the other hand, an overload of new information hinders our ability to distinguish signal from noise and to retrieve meaning—essentially, a situation that offers too much information may be judged to be meaningless and thus boring. The information-processing account offers a plausible explanation as to why repetition does not always have to lead to boredom: not all repetitive situations or stimuli are lacking in meaning. Some in fact might gain meaning in virtue of their repetitiveness: e.g., musical performances, religious rituals, mindfulness practices, or comedy routines.<sup>5</sup> Whether a repetitive situation contains meaning or not depends, to a large extent, on our expectations, background beliefs, and on our ability to engage with and retrieve meaningful information from the situation.

In light of the important role that the psychological states of the experiencing agent play in the experience boredom, a more promising approach of determining the antecedents of boredom is to look for some psychological condition that if present would give rise to boredom. This too will be a conditional approach, but the antecedents of the relevant conditionals will be, in an important sense, subjective insofar as they will involve psychological states (perceptions, cognitive processes, appraisals, judgments, or even feelings) that arise on account of the agent's interaction with their environment (external or internal). Such an interactionist approach is in line with theoretical articulations of boredom that emphasize the importance of interpretation of one's situation in order for the experience of boredom to arise (Van Tilburg & Igou, 2012; Eastwood et al., 2012). It is also in agreement with qualitative data that shows that experience of boredom relates to the perception of one's situations or to the agent's feelings, moods, and thought processes (Harris, 2000).

By adopting an interactionist approach, the functional model, I hold, posits that boredom is a "transactional" phenomenon that arises in situations which are experienced (felt, appraised, or judged) by the agent to be *cognitively unsatisfactory*. The functional model thus follows a widely accepted view in boredom literature that conceives of boredom as the outcome of an unmet need or desire for satisfactory cognitive engagement (Eastwood et al., 2012; Fahlman et al., 2013; Fenichel, 1953; Tam et al., 2021; Todman, 2003). Such an articulation of the antecedents of boredom makes evident the need for a clear description of the nature of satisfactory engagement. Although different functional views could spell the notion of satisfactory cognitive engagement differently, here I offer the following characterization. Satisfactory cognitive engagement with a situation requires both (a) *direct* cognitive engagement with the situation (i.e., being able to pay attention to our situation) and (b) the realization that the psychological/cognitive costs of sustaining direct cognitive

involvement with our situation are acceptable to us. In other words, our need for satisfactory cognitive engagement is met when we are paying attention to our situation and are willing to undergo the psychological/cognitive costs associated with maintaining such a direct cognitive relationship with our situation. Consequently, boredom will arise when we desire to cognitively and satisfactorily engage with an object but we cannot: either because we cannot establish a direct cognitive relationship with the object (due to endogenous or exogenous factors we cannot pay attention to the object or adequately deploy our attentional resources), or because we deem the psychological/cognitive costs of our direct cognitive relationship with the object to be too high (engagement with the object is experienced as too effortful or judged to be meaningless/lacking in value), or because of both.

It is worth noting that the two components of satisfactory cognitive engagement—direct cognitive engagement and determination of the overall psychological/cognitive costs of sustaining direct cognitive engagement—can interact with each other. Certain situations, objects, or tasks might require from us less cognitive effort in order to cognitively engage with them in a direct manner. Because of that, a determination of whether the costs of our current direct involvement are acceptable will be influenced by the perceived effort required to sustain direct cognitive engagement, which in turn depends on the complexity of our current task. So, both perceived effort and difficulty or complexity of task turn out to be relevant factors when considering whether a situation will elicit boredom (Csikszentmihalyi, 1975; Kurzban et al., 2013). Additionally, our perceptions of what is boring will also be affected by the presence or absence of alternative options for cognitive engagement (for an ingenious experiment illustrating the effect of alternative options on our experience of boredom, see Struck et al., 2020). Specifically, the introduction or elimination of alternative options will affect the experiencing agent's calculus of opportunity costs. Depending on the psychological/cognitive

costs (and benefits) of these alternative options, the object of current direct engagement may appear to be boring to the subject because it may cease to be an object of satisfactory cognitive engagement: with the introduction of new possibilities, the opportunity costs change; indeed, they can change so much that the effort needed to sustain direct cognitive engagement with our current option has become unacceptable or too costly to us.

Both cognitive features that were detailed in the previous section—attentional difficulties and negative appraisals—are relevant here. The notion of direct cognitive involvement can be naturally explicated in terms of attention insofar as a direct cognitive engagement requires the proper deployment of attentional resources. Furthermore, given that satisfactory cognitive engagement with an object is one that requires us to pay attention to that object, then boredom (which arises as a response to unsatisfactory cognitive engagement) is shown to be intimately related to attentional difficulties or the misallocation of attentional resources—a result that is supported by extant empirical evidence (Hunter and Eastwood 2013; Westgate & Wilson, 2018) and theoretical articulations of boredom (Eastwood et al., 2012; Tam et al. 2021; Westgate & Wilson, 2018). Tam and colleagues (2021) have argued “that boredom tends to be experienced when there is IAE [inadequate attentional engagement],” which according to them “is the discrepancy between one’s *actual level* (i.e., objectively measurable) of attentional engagement and subjectively *desired level* of attentional engagement” (p. 255). By maintaining that boredom arises when one desires but cannot achieve satisfactory cognitive engagement, the proposed articulation of the functional view of boredom is consistent with the theoretical view advanced by Tam and colleagues. Having said that, the functional account on offer adds to Tam et al.’s view by explicating their talk of “subjectively *desired levels* of attentional engagement” in terms of (the determination of relevant) opportunity costs (Kurzban et al., 2013). Attentional engagement is thus subjectively

desired *if* the psychological/cognitive costs of maintaining such engagement are deemed acceptable to the subject given the subject's prior beliefs and expectations.

Furthermore, the proposed model accounts for the observation that negative appraisals are common antecedents of boredom. Negative appraisals can affect both one's willingness to attend to a situation and the psychological/cognitive costs (and benefits) of sustaining a direct cognitive connection with the situation. On the one hand, negative appraisals of one's situation will make it less likely that a subject will pay attention to one's situation. Judging that a situation is meaningless, repetitive, unchallenging, e.g., would act as a deterrent to pay attention to the situation. On the other hand, negative appraisals will play a role in the determination of opportunity costs. If the object of our current cognitive engagement is deemed to be meaningless, repetitive, uninteresting, then the opportunity costs will increase. As a result, situations that are appraised negatively will tend to elicit boredom.

-In sum, the functional account yields a necessary condition for the onset of boredom. Boredom requires the realization (a perception, judgment, appraisal, or feeling) that one's current situation fails to fulfil one's need for satisfactory cognitive engagement. This necessary condition highlights not only the cognitive aspects of the experience of boredom, but also its volitional character: there cannot be a state of boredom without a desire (or need) for more than what one is given. Lastly, the variety of the functional view that is proposed here also makes clear the significance of understanding boredom through an opportunity-cost perspective (Kurzban et al. 2013; Martarelli, Wolff, & Bieleke, 2021; Struk et al., 2020; Todman, in press; Wojtowicz, Chater, & Lowenstein, 2021). Indeed, whether boredom arises depends not just on some objective characteristic of the task with which we are engaging, but also on our perceptions of effort and value associated both with our present task and alternative tasks.

## **Output**

Boredom's proposed function is the regulation of cognitive engagement. If a mismatch between need for satisfactory cognitive engagement and actual cognitive engagement is the necessary antecedent of boredom, then, according to the functional view, the intended outcome of boredom is the fulfilment of this need, namely, the restoration of satisfactory cognitive engagement. On account of the affective, cognitive, volitional, and even physiological concomitants of boredom, the subject will be motivated to act in ways to restore satisfactory cognitive engagement. In other words, the painful realization that one is no longer cognitively engaging with a situation in a satisfactory manner will be a drive to restore satisfactory cognitive engagement.

Given the proposed notion of satisfactory cognitive engagement, there are two broad courses of action that could restore satisfactory cognitive engagement. First, the subject can seek escape from the current object of cognitive engagement and pursue a different object of cognitive engagement with the hope that this new object will give rise to satisfactory cognitive engagement. Second, one might be motivated to restore satisfactory cognitive engagement not by seeking out a new object of cognitive engagement but by re-evaluating one's relationship to that object. For instance, subjects can re-think the cognitive costs (or benefits) of their current cognitive engagement (cognitive reappraisal) or attempt to make their engagement less effortful (e.g., by gamifying their task). Both attempts of changing one's relationship to one's object of cognitive involvement have the same aim: they alter the opportunity costs associated with the task in hand. Moreover, these strategies are likely to be deployed in situations in which the subject is unable to engage in some other form of cognitive engagement or in cases for



which there is a strong incentive for the subject to remain engaged with the current task (e.g., in school or occupational settings).

The actual outcomes of boredom—i.e., the behaviors that a subject initiates on account of boredom and with the aim to restore satisfactory cognitive engagement—are diverse and many. Different individuals respond to boredom differently, and situations that elicit boredom do not all call for the same response. Boredom may give rise to a risky endeavour, a pro-social act, an absorbing conversation, a new challenge, a walk, an act of mind-wandering, but also a change in one's emotional states. There are too many outputs of boredom to be listed here (Elpidorou, 2020). What will resolve the perceived mismatch between desired and actual cognitive engagement depends not only on the agent's beliefs, desires, dispositions, and, in general, on their psychological makeup, but also on situational factors. It is a virtue of the functional view that it can accommodate for the observed variability regarding the outcomes of boredom.

Although extant descriptions of the functional account of boredom emphasize the successful execution of boredom's function (e.g., Elpidorou 2014), i.e., cases in which the perceived mismatch between desired and actual cognitive engagement is resolved by a change of situation, the functional account must explain not only the successes of boredom but also its failures. In addition to cases in which boredom functions successfully, there will be cases in which boredom, just like any other emotional and psychological state, either malfunctions or simply fails to perform its function due to situational constraints.

For a case in which boredom fails to perform its function consider a boring situation that offers the agent no escape (e.g., a long shift or a tedious meeting). Stuck in this situation, the agent remains in a state that is characterized by a mismatch between desired cognitive engagement and actual engagement. Because the situation meets the necessary condition of

boredom, the affective, cognitive, volitional, and even physiological concomitants of boredom will persist for some time—either until the situation changes and thus the subject is able to restore satisfactory cognitive engagement or until boredom gives way to some other psychological state (apathy, despair, resignation, or depression) (Bargdill, 2000).

Boredom will malfunction when its onset fails to restore satisfactory cognitive engagement even though satisfactory cognitive engagement is not precluded by situational factors. There can be many reasons as to why this regulatory failure takes place. Here I mention two. First, in light of the provided characterization of satisfactory cognitive engagement, a chronic failure to adequately deploy attentional resources or the possession of inappropriate expectations regarding the value or difficulty of one's situations could preclude the successful regulation of cognitive engagement. Regardless of what the subject does, they cannot find satisfactory cognitive engagement. Second, boredom might fail to contribute to the restoration of satisfactory cognitive engagement if the subject is unable to muster up the psychological resources necessary to initiate escape out of the situation that is the presumed cause of the cognitively unsatisfactory situation. Mugon, Struk, and Danckert (2018) offer preliminary evidence in support of this potential malfunction of boredom by reporting a negative correlation between locomotion (the aspect of self-regulation that involves the commitment of one's psychological resources to initiate and maintain goal-directed activity; Kruglanski et al., 2000) and boredom proneness (a tendency to experience boredom frequently).

Our discussion of the function and possible malfunctions of boredom makes evident that the intended output of boredom is a situation that is unlike the input situation. Because of that, boredom can be adequately characterized as a self-effacing emotion. In other words, boredom is the psychological-behavioral transition that aims to “rescue” us from what initiated the transition in the first place. This self-effacing nature is possessed not only by boredom but

also by other emotions and psychological states. It also coheres with evolutionary accounts of emotions that conceive of them as attempted solutions to recurring problems. Disgust, for instance, motivates withdrawal behavior from the stimulus that gives rise to disgust and in doing so, it leads the emoting agent in a situation that is no longer disgusting. Pain works in a similar manner for it can be understood as a mechanism that protects us, among other things, from harmful or potentially harmful stimuli (Eccleston & Crombez, 1999; Koster et al., 2004; Van Damme et al., 2007).

### **Input-Output Relationship**

In addition to specifying the input and output of boredom, the functional model must also provide information as to how boredom executes the input-output transition that is essential to it. That is to say, the functional account ought to explain how the various affective, cognitive, volitional, and physiological changes that the input state brings about facilitates the psychological-behavioral transition characteristic of boredom.

The onset of boredom gives rise to an aversive sensation. This is almost a truism in discussions of boredom and a claim that is widely supported by experimental evidence (for references, see section 2.1.). The fact that boredom is aversive is also predicted by the variety of functional view that is offered here. Boredom arises when cognitive engagement is no longer satisfactory. Unsatisfactory cognitive engagement involves attentional difficulties and/or high psychological/cognitive costs for sustaining direct cognitive engagement with the object of cognitive engagement. Both causes of unsatisfactory cognitive engagement will likely give rise to aversive feelings. On the one hand, the disruption of flow or cognitive errors that are the products of inattention or misallocation of attentional resources are associated with aversive feelings (see Eastwood et al, 2012). On the other hand, the effort associated with

sustaining direct attention when opportunity costs are high is theorized to give rise to aversive feelings (Kurzban et al., 2013).

The associated aversive phenomenology of boredom will motivate one to seek escape both from the situation that is thought to be responsible for the feeling of boredom and from the feeling itself. This motivational effect of the phenomenological feeling is amplified by the cognitive and volitional changes brought about by the input state. Because of its very nature, the input state is appraised as being unsatisfactory, unengaging, or lacking in meaning. We are unable to sustain attention and we wish to do something else. In addition, we often mind wander and perceive a slower passage of the time. Such characteristics make our situation all the more aversive, increasing even further our desire to escape from it. The presence of mind wandering permits us to think of other situations that we would rather pursuing.

Lastly, the physiological changes that are associated with the onset of boredom are also conducive to its function. A decrease in arousal helps one to further disengage with the input situation. An increase in arousal readies one for action which in the case of boredom is characterized by an attempt to escape the input situation. Activation of the Default Mode Network is suggestive of mind wandering (or at least, the turning of one's attention "inwards") (Danckert & Merrifield, 2016; Ulrich et al., 2014), and the findings from encephalographic recordings reported in section 2.4 show that the onset of boredom makes it harder for one to remain cognitively engaged with one's situation (Katahira et al., 2018; Perone, Anderson & Weybright, 2020; Tabatabaie et al., 2014; Yakobi, Boylan, and Danckert, 2021).

What the functional account ultimately offers is more than a mere description of what goes on during boredom. It identifies boredom with a second-order property or a role. Boredom is the attempted psychological-behavioral transition from an input state (a perceived mismatch between desired cognitive engagement and actual cognitive engagement) to an

output state (the resolution of this mismatch). In other words, boredom signals the presence of unsatisfactory cognitive engagement and promotes the restoration of forms of cognitive engagements that are satisfactory. Not only is the functional definition of boredom consistent with available evidence regarding the character of boredom, it also shows how the different components of the state that we call “boredom” are components of one of the same state: these are all rightly considered to be components of boredom because jointly they execute boredom’s function.

#### **4. REFLECTIONS ON THE FUNCTIONAL MODEL**

##### **4.1. Agreement and disagreement within the functional camp**

The foregoing presentation of the functional view of boredom describes the basic commitments of the functional view and explains the manner in which it can accommodate available findings. Ultimately, the functional account conceives of boredom as a regulatory state: boredom signals that our current situation is non-optimal and motivates one to engage in an alternative situation that is perceived as a better fit for the agent (Danckert, Mugon, et al., 2018; Elpidorou 2014, 2018a, 2018b; Van Tilburg & Igou 2011, 2012; Wolff & Martarelli, 2020).

Beyond this initial agreement, there is room for disagreement even amongst proponents of the functional view. Perhaps the most important point of potential contention concerns the driving mechanism behind the regulatory aspect of boredom. Is it the pursuit of interest or at least the avoidance of meaninglessness? (Van Tilburg & Igou, 2012) Is it the search of novelty or stimulation? (Bench & Lench, 2019) Is it an affective cost-benefit analysis that aims to move the subject out of a situation that is perceived to be costly (compared to

other alternative ones) and into one that is more beneficial or less costly (Kurzban et al., 2013)? Or is the restoration of satisfactory cognitive engagement, as it was presented in this essay?

Another point of contention among proponents of the functional view concerns the nature of boredom's physiological arousal. For instance, Bench and Lench (2013) hold that boredom is a functional emotion because it is both a state that conveys information about the nature of our current activity and one that can motivate us to pursue an alternative activity when the intensity of our current experience fades. Bench and Lench hold that boredom is an emotion of high arousal and argue that such a feature of boredom contributes to its motivational function insofar as it prepares one for action. Other presentations of the functional account do not insist that boredom has a specific physiological arousal—in fact some deny altogether the claim that arousal is a determining characteristic of boredom (Elpidorou, 2021). Instead, boredom's function can be served either when there is a decrease in arousal (insofar as such a change can deactivate one from the boring situation) or when there is an increase in arousal (insofar as such a change can prepare one for action and movement).

These are important issues that would need to be resolved through further empirical research. Having said that, such disagreements appear to be internal to the functional view and regardless of how they are settled, they do not affect the general principles of the functional picture

#### **4.2. Good or bad?**

Does the functional view of boredom entail that boredom is beneficial? The answer is both “Yes” and “No.” If the functional view is accepted, then boredom is identified with a role: boredom is the attempted transition from an input state (a perceived state of unsatisfactory

cognitive engagement) to an output state. Understood as a psychological-behavioral transition, it is hard to see boredom as anything but a boon. Boredom signals the presence of unsatisfactory (or non-optimal) situations and motivates escape from them. It is an affective tool that helps us to regulate our behavior, to keep us moving, and that can potentially rescue us from prolonged states of discontent.

Of course, the claim that boredom is a functional state does not entail that every exercise of its function is beneficial to the experiencing agent. Possible malfunctions of boredom were discussed in the previous section. But even when boredom does not malfunction, there is no guarantee that its exercise will always be beneficial. Numerous studies have demonstrated the potential of boredom to bring harm to the experiencing agent (Bench and Lench, 2019; Nederkoorn et al., 2016; Wilson et al., 2014) and to others (Danckert in press; Elpidorou 2020; Pfattheicher et al. 2020). Indeed, risk-taking activities are ones that many will find interesting and exciting and as such will provide a solace from boredom. At the same time, such activities are associated with potential dangers. What is more, individuals might find a situation boring even though they should not. Consider, for instance, the experience of boredom within academic contexts (Belton and Priyadharshini 2007; Mann and Robinson 2009; Pekrun et al., 2010 and 2014; Vogel-Walcutt et al., 2012). Assuming that the academic activity is important for the subject, the experience of boredom does not allow the subject to focus on the activity, leading potentially to an outcome that is not beneficial to the subject. To be clear, the fact that boredom does not *always* play a salutary role in our lives does not vitiate its importance in our lives nor does it take away its regulatory function. Many of our emotional states (e.g., fear, anger, pride, joy) can have both beneficial and harmful consequences. And so can most of our regulatory drives or states (hunger, thirst, etc.). An understanding of both the benefits and harms of boredom is a necessary step in the direction

of explicating its nature even more clearly.

### **4.3. Benefits of the functional account**

The functional account of boredom carries a number of theoretical advantages. Here, I briefly discuss the following three.

#### **A. Animal research**

The functional account can inform research investigating the experience of boredom in non-human animals (Burn, 2017; Meagher & Mason, 2012; Wemelsfelder, 1985, 1991, 2005). Armed with a functional definition of boredom, researchers can investigate whether non-human animals exhibit similar psychological-behavioral transitions when placed in seemingly boring situations. Because of its functional nature, boredom can be studied in non-human animals without demanding a close neurological similarity between them and humans. Not only that, but the functional definition can allow researchers to differentiate between the experience of boredom and that of apathy in non-animals: only the latter is associated with motivational loss and lack of an attempt to escape one's situation. Lastly, if non-human animals do in fact experience boredom, then the experience of boredom is unlikely to be conceptually demanding. In fact, it could be argued that perceived meaninglessness cannot be an essential component of animal boredom (see also Svendsen 2019). This conclusion might force proponents of functional accounts of boredom to steer away from views that render search for meaning the sole mechanism responsible for the regulatory aspect of boredom.

#### **B. Distinguishing boredom from frustration**



The functional definition allows us to distinguish between boredom and other related emotions. Consider the case of frustration. Although it is customary to distinguish between boredom and frustration in terms of their associated levels of physiological arousal (boredom is a low arousal state whereas frustration is a high arousal state) such distinction appears to be problematic. Empirical evidence shows that boredom may involve activation in physiological arousal (e.g., Barmack, 1937; Braby et al., 1992; Geiwitz, 1966; Giakoumis et al., 2010; Kim et al., 2018; London et al., 1972; Lundberg et al., 1993; Pattyn et al., 2008). and that it is often subjectively experienced as an agitated state (Harris, 2000; Martin et al., 2006; Steinberger et al., 2016). Moreover, there have been theoretical attempts to show that boredom does not have a specific physiological arousal (Hill & Perkins, 1985; Elpidorou, 2021) and measures of state boredom have defined and operationalized boredom as a state that is both high and low in arousal (Fahlman et al., 2013).

The functional account provides a solution to this problem. What distinguishes boredom from frustration is not the fact that the former is a deactivating state whereas the latter is not, but a difference in their respective functions. Whereas boredom's function is to motivate the organism to escape from a situation that yields a perceived mismatch between desired cognitive engagement and actual cognitive engagement, frustration motivates the organism to keep trying to overcome the obstacle that gives rise to frustration (Amsel, 1992; Grimm, 2008; Jeronimus & Laceulle, 2017; Yu, 2016). What is more, the functional account can contribute to the development of more accurate measures of boredom. If it turns out that boredom and frustration are distinguished in terms of their respective functions and not in terms of differences of physiological arousal, then self-report measures ought to include items that capture functional differences, perhaps by asking questions regarding what one would do in various situations, and should avoid items that focus too heavily on how arousal is

subjectively experienced. In turn, other measures of boredom, ones that do not rely on self-report items (e.g., those used in affective computing), should not look for differences in physiological correlates in order to distinguish between boredom and frustration, but to differences in behavior which are more likely to be indicative of respective differences in function.

Struk and colleagues (2021) have reported that the experience of boredom is associated with both high and low levels of perceived control, whereas frustration is associated only with low levels of perceived control. The proposed functional view of boredom offers a potential explanation for boredom's relationship to perceived control. Both conditions (high and low perceived control) could be construed as indications of *unsatisfactory* cognitive engagement. High perceived control would likely suggest to the subject that there is no more new information that could be extracted from the situation—a result that could subsequently affect the subject's willingness to attend the situation and also bring about a decrease in the perceived value of cognitive engagement with the situation (or even an increase in the value of pursuing alternative situations). Low perceived control could also hinder satisfactory cognitive engagement but by affecting the amount of effort required in order to pay attention to such a situation. If the required effort to attend is too high, then the subject would be disincentivised to pay attention to the situation and thus a low control condition could preclude satisfactory cognitive engagement.

To be clear, the aforementioned explanation of boredom's (quadratic) relationship to perceived control is, at this point, speculative and ought to be tested experimentally. What is important to point out is that the functional view of boredom offers a natural explanation to Struk and colleagues (2021)'s *additional* result that boredom and frustration differ in terms of their associations with perceived control. As mentioned above, the functional view

distinguishes boredom from frustration in terms of their respective functions. Whereas boredom aims to restore satisfactory cognitive engagement, frustration aims to assist an agent in their attempt to overcome the obstacle that gave rise to frustration in the first place. Such a functional distinction is consistent with what Struk and colleagues (2021) reported in the case of frustration, namely, that it was associated only with situations characterized by low perceived control. Given its function, frustration is not expected to arise in situations that are characterized by high perceived control. Such situations will not be perceived by an agent as obstacles to their goals and it is thus unlikely for them to elicit frustration.

### **C. The relationship between state and trait boredom**

Boredom researchers distinguish between state boredom and trait boredom. On the one hand, state boredom is a transitory emotional experience. On the other hand, trait boredom is a personality trait, i.e., the propensity to experience boredom frequently and in a wide range of situations. Researchers assess the presence of trait boredom using self-report measures (i.e., questionnaires). Although there is a wealth of research utilizing some measure of trait boredom and investigating the correlates of trait boredom, there are important theoretical issues with the current understanding of trait boredom. The psychometric properties of commonly used measures of trait boredom (BPS) appear to be problematic (Melton and Schulenberg, 2009; Struk et al., 2017; Vodanovich, 2003). Furthermore, it is unclear what measures of trait boredom exactly measure: do they measure a propensity to experience boredom or one's inability to adequately deal with the onset of boredom (Danckert, Hammerschmidt, et al., 2018; Gana et al., 2019)? Both articulations are consistent with the self-report measures currently used in order to evaluate trait boredom. Lastly, the relationship between trait boredom and state boredom is unclear.

Although the functional model focuses exclusively on state boredom, it can be used as a starting point for theorizing about the relationship between state boredom and trait boredom. Specifically, one hypothesis consistent with the functional model is the idea that trait boredom is the result of a systematic malfunction of (state) boredom. As it was already mentioned, boredom can malfunction when the onset of boredom fails to resolve the perceived mismatch between desired and actual cognitive engagement. In other words, boredom fails to fulfill its function when it either fails to move the agent out of the input state or when it leads the agent into a new situation that is similar to the input state insofar as it is also characterized by a perceived mismatch between desired and actual cognitive engagement.

The proposed relationship between state boredom and trait boredom yields empirically testable predictions for it relates the presence of trait boredom to difficulties in self-regulation, self-awareness, the ability to interpret one's emotional states, and the ability to cognitively engage in a satisfactory manner with one's situation. Specifically, the proposal predicts that an inability to initiate motion (e.g., low in the locomotion component of the self-regulatory model) can give rise to frequent and prolonged affective, volitional, and cognitive, and physiological changes associated with the experience of boredom because one would remain stuck in the input state that brings about those changes. A lack of knowledge regarding what one finds cognitively engaging could also lead to a more frequent experience of boredom because even if one is capable of motivating oneself to pursue an alternative situation, one might be incapable of finding a situation that resolves the issues that gives rise to boredom in the first place. In turn, a difficulty to understand what one is feeling can also contribute to the frequent or prolonged experience of boredom because one might be incapable of appreciating what is giving rise to boredom and as such one might not be able to use boredom's motivational force as a way to escape the input situation. Finally, factors that can hinder

satisfactory cognitive engagement (attentional difficulties or inappropriate expectations regarding the value of one's situations) are also predicted to be relevant factors for the presence of frequent or chronic boredom. Contrarywise, the functional model predicts that individuals who are capable of moving from one situation to another, who have clear goals and desires, who are capable of interpreting and understanding their emotional states, who do not experience chronic attentional difficulties, and who have adequate expectations about the value of their situations will be less likely to score high on measures of trait boredom compared to those who lack these characteristics. In support of the proposed relationship between self-regulation and trait boredom, Struk and colleagues (Struk et al., 2016) have shown that high locomotion (the component of self-regulation that is supposed to reflect one's ability to initiate motion) is strongly negatively correlated with boredom proneness.

### **4.3. Limitations**

The functional model is not without its challenges. First, it is a theoretical account of boredom and thus proponents of the functional account ought to make clear how it can be falsified. In response to this demand, proponents of the functional model could suggest that if there is a state called "boredom" but is completely apathetic—insofar as in such a state one experiences a motivational loss—then such a type of boredom will not be able to serve the proposed function of boredom and thus the functional view would be falsified. Stated otherwise, if we have reasons to count a completely deactivating state as a state of boredom, then the functional account would have failed to capture the essence of boredom. Moreover, if the provided descriptions of the input of boredom, intended outcomes of boredom, or the input-output transition characteristic of boredom are not accurate, then the functional view would have to be revised or rejected.

Second, the functional view is necessarily committed to the view that boredom is a functional state. Because of that, it is important for proponents of the functional account to provide evidence in support of this basic premise by supplementing their theoretical account with biological and evolutionary considerations that would make it plausible that boredom is either an adaptation or exaptation (Lench et al., 2015).

Last, the functional account appears to be a backward-looking model. That is, it utilizes available evidence on the character of boredom in order to come up with the function of boredom. It is thus important for proponents of this account to show how it can concretely advance research on boredom. Can the view generate novel predictions? Can it solve problems within boredom research? And in general, can it actively further our understanding of boredom? Although some work has been done to address these concerns, much more needs to be done.

## **5. CONCLUSION**

The functional account is a promising theoretical approach to boredom. Although it is not the only available theory of boredom, it has discernible benefits: *inter alia*, it can incorporate extant empirical evidence; it can offer a clear articulation of boredom; and it yields testable predictions and opens up new avenues for research. If the functional account is accepted, then boredom ought to be identified with a role or second-order property: that is, boredom is the agentic or organismic property of having properties that are jointly capable of instantiating a transition from an input state (a perceived state of unsatisfactory cognitive engagement) to an output state (a perceived state of satisfactory cognitive engagement). Boredom, in other words, is most fundamentally a mechanism for cognitive change. This is, in short, the view of the functional theory of boredom.

---

## NOTES

<sup>1</sup> The psychodynamic theory has fallen out of fashion. However, recent work on boredom has emphasized the importance of a volitional component in the experience of boredom and argued that the presence of an unfulfilled or ill-formed desire during the experience of boredom reveals a disruption of agency that is characteristic of the experience of boredom (Danckert & Eastwood, 2020; Eastwood & Gorelik, in press).

<sup>2</sup> Even though the MAC Model combines insights from both the existential and cognitive (specifically, attentional) theories of boredom, I am inclined to count it as a distinct account of boredom. This is for two reasons. First, it holds that attentional difficulties and perceived meaninglessness are individually sufficient but not necessary for the experience of boredom. This commitment on behalf of the MAC Model distinguishes it from attentional and existential views: those views insist, respectively, that attentional difficulties and perceived meaninglessness are necessary for the experience of boredom (for a discussion of the differences between the MAC Model and the attentional view, see Tam et., 2021). Second, and perhaps more importantly, the MAC Model entails that, depending on its causes and outcomes, there can be distinct kinds of boredom: attentional boredom, meaningless boredom, and mixed boredom. On the issue of whether there are distinct kinds of boredom, see Elpidorou (2021) and Goetz et al. (2014).

<sup>3</sup> Throughout the essay I consider boredom to be an emotion. Such treatment is in line with common practice within the psychology of boredom. Although I believe that there are good reasons to treat boredom as an emotion, it is not necessary to rehearse them here. The characterization of the functional view of boredom that I advance in this paper holds regardless of whether state boredom is ultimately an emotion, a mood, a cognitive attitude (Yao, in press), a feeling (Eastwood & Gorelik, in press), or some other kind of psychological state. Still, readers interested in arguments in support of the view that boredom is an emotion should consult Bortolotti & Allifi, in press; Elpidorou, 2018b, in press; Van Tilburg & Igou, 2017a; Yucel & Westgate in press.

<sup>4</sup> Danckert (2019) offers a different account of boredom's evolutionary origins. He argues that boredom arose as a signal to balance the drives of exploration and exploitation. See also Gomez-Ramirez & Costa (2017).

<sup>5</sup> For comedy routines, see, e.g., James Acaster's Kettering Town FC routine or Kurt Braunohler and Kristen Schaal's *Kristen Schaal is a Horse* sketch, both of which rely on repetition in order to provoke laughter. Many thanks to an anonymous reviewer for helpful comments on the information-processing view of boredom.

## 6. REFERENCES

- Acee, T. W., Kim, H., Kim, H. J., Kim, J. I., Chu, H. N. R., Kim, M., ... & Boredom Research Group. (2010). Academic boredom in under-and over-challenging situations. *Contemporary Educational Psychology, 35*(1), 17-27.
- Adolphs, R., & Anderson, D. J. (2018). *The neuroscience of emotion: a new synthesis*. Princeton University Press.
- Adolphs, R., & Andler, D. (2018). Investigating emotions as functional states distinct from feelings. *Emotion Review, 10*(3), 191-201.
- Ahmed, S. M. S. (1990). Psychometric properties of the boredom proneness scale. *Perceptual and Motor Skills, 71*, 963–966.
- Amsel, A. (1992). *Frustration Theory: An analysis of dispositional learning and memory*. Cambridge: Cambridge University Press.
- Barbalet, J. M. (1999). Boredom and social meaning. *The British Journal of Sociology, 50*(4), 631–646.
- Bargdill, R. (2000). The study of life boredom. *Journal of Phenomenological Psychology, 31*(2), 188-219.
- Barmack, J. E. (1937). Boredom and other factors in the physiology of mental effort: An exploratory study. *Archives of Psychology, 31*, 9–10.
- Barwick, F., Arnett, P., & Slobounov, S. (2012). EEG correlates of fatigue during administration of a neuropsychological test battery. *Clinical Neurophysiology, 123*(2), 278–284.
- Belton, T., & Priyadharshini, E. (2007). Boredom and schooling: A cross-disciplinary exploration. *Cambridge Journal of Education, 37*(4), 579–595.
- Bench, S. W., & Lench, H. C. (2013). On the function of boredom. *Behavioral Sciences, 3*(3), 459–472.
- Bench, S. W., & Lench, H. C. (2019). Boredom as a seeking state: Boredom prompts the pursuit of novel (even negative) experiences. *Emotion, 19*(2), 242-254.
- Berlyne, D. E. (1960). *Conflict, arousal and curiosity*. New York, NY: McGraw-Hill.
- Bernstein, H. E. (1975). Boredom and the ready-made life. *Social Research, 42*, 512–537.



- Bortolotti, L. & M. Aliffi. (in press). The Epistemic Benefits of Irrational Boredom. In A. Elpidorou (Ed.), *The Moral Psychology of Boredom*. London: Rowman & Littlefield.
- Boylan, J., Seli, P., Scholer, A. A., & Danckert, J. (2021). Boredom in the COVID-19 pandemic: Trait boredom proneness, the desire to act, and rule-breaking. *Personality and Individual Differences, 171*, 110387.
- Braby, C. D., Harris, D., & Muir, H. C. (1993). A psychophysiological approach to the assessment of work underload. *Ergonomics, 36*, 1035–1042.
- Bull, P. E. (1987). *Posture Gesture* (International series in experimental social psychology, volume 16). Oxford: Pergamon Press.
- Burn, C. C. (2017). Bestial boredom: A biological perspective on animal boredom and suggestions for its scientific investigation. *Animal Behaviour, 130*, 141-151.
- Caldwell, L. L., Darling, N., Payne, L. L., & Dowdy, B. (1999). “Why are you bored?”: An examination of psychological and social control causes of boredom among adolescents. *Journal of Leisure Research, 31*(2), 103-121.
- Carriere, J. S., Cheyne, J. A., & Smilek, D. (2008). Everyday attention lapses and memory failures: The affective consequences of mindlessness. *Consciousness and Cognition, 17*(3), 835-847.
- Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review, 97*(1), 19–35. <https://doi.org/10.1037/0033-295X.97.1.19>
- Carver, C. S., & Scheier, M. F. (2013). Goals and emotion. In M. D. Robinson, E. R. Watkins, & E. Harmon-Jones (Eds.), *Guilford handbook of cognition and emotion* (pp. 176–194). New York: Guilford Press.
- Chan, C. S., van Tilburg, W. A., Igou, E. R., Poon, C. Y., Tam, K. Y., Wong, V. U., & Cheung, S. K. (2018). Situational meaningfulness and state boredom: Cross-sectional and experience-sampling findings. *Motivation and Emotion, 42*(4), 555-565.
- Cheyne, J. A., Carriere, J. S. A., & Smilek, D. (2006). Absent-mindedness: Lapses of conscious awareness and everyday cognitive failures. *Consciousness and Cognition, 15*(3), 578–592.

- Chin, A., Markey, A., Bhargava, S., Kassam, K. S., & Loewenstein, G. (2017). Bored in the USA: Experience sampling and boredom in everyday life. *Emotion, 17*(2), 359-368.
- Cosmides, L. & Tooby, J. (2000). Evolutionary Psychology and the Emotions. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions*, 2nd edition. New York: Guilford Press, 91-115,
- Craig, S. D., D'Mello, S., Witherspoon, A., & Graesser, A. (2008). Emote aloud during learning with AutoTutor: Applying the facial action coding system to cognitive–affective states during learning. *Cognition and Emotion, 22*(5), 777–788.
- Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety*. San Francisco, CA: Jossey-Bass.
- Damrad-Frye, R., & Laird, J. D. (1989). The experience of boredom: The role of the self-perception of attention. *Journal of Personality and Social Psychology, 57*, 315–320.
- Danckert, J. (2019). Boredom: Managing the delicate balance between exploration and exploitation. In J. Ros Velasco (Ed.), *Boredom Is In Your Mind* (pp. 37-53). Cham: Springer.
- Danckert, J. (in press). “Rage Spread Thin”: Boredom and Aggression. In A. Elpidorou (Ed.), *The Moral Psychology of Boredom*. London: Rowman & Littlefield.
- Danckert, J. A., & Allman, A. A. A. (2005). Time flies when you’re having fun: Temporal estimation and the experience of boredom. *Brain and Cognition, 59*(3), 236-245.
- Danckert, J., & Eastwood, J. D. (2020). *Out of My Skull: The Psychology of Boredom*. Cambridge, MA: Harvard University Press.
- Danckert, J., Hammerschmidt, T., Marty-Dugas, J., & Smilek, D. (2018a). Boredom: Under-aroused and restless. *Consciousness and cognition, 61*, 24-37.
- Danckert, J., & Merrifield, C. (2016). Boredom, sustained attention and the default mode network. *Experimental Brain Research, 1–12*.
- Danckert, J., Mugon, J., Struk, A., & Eastwood, J. (2018b). Boredom: What Is It Good For?. In H. Lench (Ed.), *The Function of Emotions* (pp. 93-119). Cham, Switzerland: Springer.
- Daniels, L. M., Tze, V. M., & Goetz, T. (2015). Examining boredom: Different causes for different coping profiles. *Learning and Individual Differences, 37*, 255–261.

- Dal Mas, D. E., & Wittmann, B. C. (2017). Avoiding boredom: Caudate and insula activity reflects boredom-elicited purchase bias. *Cortex*, *92*, 57-69.
- Daschmann, E. C., Götz, T., & Stupnisky, R. H. (2011). Testing the predictors of boredom at school: Development and validation of the precursors to boredom scales. *British Journal of Educational Psychology*, *81*(3), 421-440.
- De Chenne, T. K. (1988). Boredom as a clinical issue. *Psychotherapy: Theory, Research, Practice, Training*, *25*, 71–81.
- Eastwood, J. D., Frischen, A., Fenske, M. J., & Smilek, D. (2012). The unengaged mind: Defining boredom in terms of attention. *Perspectives on Psychological Science*, *7*(5), 482–495.
- Eastwood, J. D., & Gorelik, D. (2019). Boredom is a feeling of thinking and a double-edged sword. In J. Ros Velasco (Ed.), *Boredom Is In Your Mind* (pp. 55-70). Cham: Springer.
- Eastwood, J. D., & Gorelik, D. (in press). Losing and Finding Agency: The Crisis of Boredom. In A. Elpidorou (Ed.), *The Moral Psychology of Boredom*. London: Rowman & Littlefield.
- Eccleston, C., & Crombez, G. (1999). Pain demands attention: A cognitive–affective model of the interruptive function of pain. *Psychological Bulletin*, *125*(3), 356-366.
- Elpidorou, A. (2014). The bright side of boredom. *Frontiers in Psychology*, *5*, 1245.
- Elpidorou, A. (2016). The significance of boredom: A Sartrean reading. In D. Dahlstrom, A. Elpidorou, & W. Hopp, *Philosophy of mind and phenomenology: Conceptual and empirical approaches* (pp. 268–283). New York: Routledge.
- Elpidorou, A. (2018a). The good of boredom. *Philosophical Psychology*, *31*(3), 323–351.
- Elpidorou, A. (2018b). The bored mind is a guiding mind: Toward a regulatory theory of boredom. *Phenomenology and the Cognitive Sciences*, *17*(3), 455–484.
- Elpidorou, A. (2020). *Propelled: How boredom, frustration, and anticipation lead us to the good life*. New York, NY: Oxford University Press.

- Elpidorou, A. (2021). Is boredom one or many? A functional solution to the problem of heterogeneity. *Mind & Language*, 36(1), 491-511. <https://doi.org/10.1111/mila.12282>
- Elpidorou, A. (In press). Précis. Propelled: How Boredom, Frustration, and Anticipation Lead Us to the Good Life. *Journal of Philosophy of Emotion*.
- Fahlman, S. A., Mercer, K. B., Gaskovski, P., Eastwood, A. E., & Eastwood, J. D. (2009). Does a lack of life meaning cause boredom? Results from psychometric, longitudinal, and experimental analyses. *Journal of Social & Clinical Psychology*, 28, 307–340.
- Fahlman, S. A., Mercer-Lynn, K. B., Flora, D. B., & Eastwood, J. D. (2013). Development and validation of the multidimensional state boredom scale. *Assessment*, 20, 68–85.
- Fan, X., Zhou, Q., Liu, Z., & Xie, F. (2015). Electroencephalogram assessment of mental fatigue in visual search. *Bio-medical Materials and Engineering*, 26(s1), 1455–1463.
- Fenichel, O. (1953). On the psychology of boredom. In O. Fenichel (Ed.), *The collected papers of Otto Fenichel* (Vol. 1, pp. 292–302). New York, NY: W.W. Norton.
- Fisher, C. D. (1993). Boredom at work: A neglected concept. *Human Relations*, 46, 395–417.
- Fiske, D. W., & Maddi, S. R. (1961). *Functions of Varied Experience*. Homewood, IL: Dorsey Press.
- Frankl, V. E. (1984). *Man's search for meaning: An introduction to logotherapy*. New York, NY: Pocket Books.
- Frijda, N. H. (1986). *The Emotions*. Cambridge, UK: Cambridge University Press.
- Frijda, N. H., & Mesquita, B. (1994). The social roles and functions of emotions. In S. Kitayama & H. R. Markus (Eds.), *Emotion and culture: Empirical studies of mutual influence* (pp. 51–87). Washington, D.C.: American Psychological Association.
- Geana, A., Wilson, R., Daw, N., & Cohen, J. D. (2016). Boredom, information-seeking and exploration. In A. Papafragou, D. Mirman, D. Grodner, & J. Trueswell (Eds.), *Proceedings of the 38th Annual Meeting of the Cognitive Science Society* (Vol. 1, pp. 1751–1756). Austin, TX: Cognitive Science Society.
- Geiwitz, P. J. (1966). Structure of boredom. *Journal of Personality and Social Psychology*, 3, 592–600.

- Gana, K., Broc, G., & Bailly, N. (2019). Does the Boredom Proneness Scale capture traitness of boredom? Results from a six-year longitudinal trait-state-occasion model. *Personality and Individual Differences, 139* (1), 247-253.
- Giakoumis, D., Vogianou, A., Kosunen, I., Moustakas, K., Tzovaras, D., & Hassapis, G. (2010). Identifying psychophysiological correlates of boredom and negative mood induced during HCI. BIOSTEC 2010, Valencia, Spain, pp. 3–12.
- Goetz, T., Frenzel, A. C., Hall, N. C., Nett, U. E., Pekrun, R., & Lipnevich, A. A. (2014). Types of boredom: An experience sampling approach. *Motivation and Emotion, 38*(3), 401–419.
- Goldberg, Y. K., Eastwood, J. D., LaGuardia, J., & Danckert, J. (2011). Boredom: An emotional experience distinct from apathy, anhedonia, or depression. *Journal of Social and Clinical Psychology, 30*(6), 647-666.
- Gordon, A., Wilkinson, R., McGown, A., & Jovanoska, A. (1997). The psychometric properties of the boredom proneness scale: An examination of its validity. *Psychological Studies, 42*, 85–97.
- Greenson, R. R. (1953). On boredom. *Journal of the American Psychoanalytic Association, 1*, 7–21.
- Grimm, J. (2008). Frustration aggression theory. *The International Encyclopedia of Communication*. [doi.org/10.1002/9781405186407.wbiecf049](https://doi.org/10.1002/9781405186407.wbiecf049)
- Hebb, D. O. (1966). *A textbook of psychology*. Philadelphia, PA: W.B. Saunders.
- Hamilton, J. A. (1981). Attention, personality, and the self-regulation of mood: Absorbing interest and boredom. *Progress in Experimental Personality Research, 10*, 281–315.
- Hamilton, J. A., Haier, R. J., & Buchsbaum, M. S. (1984). Intrinsic enjoyment and boredom coping scales: Validation with personality, evoked potential, and attention measures. *Personality and Individual Differences, 5*, 183–193.
- Harris, M. B. (2000). Correlates and characteristics of boredom proneness and boredom. *Journal of Applied Social Psychology, 30*, 576–598.
- Hartocollis, P. (1972). Time as a dimension of affects. *Journal of the American Psychoanalytic Association, 20*, 92–108.

- Hasselton, M. G., & Ketelaar, T. (2006). Irrational Emotions or Emotional Wisdom? The Evolutionary Psychology of Emotions and Behavior. In J. P. Forgas (Ed.), *Affect in Social Thinking and Behavior*. New York: Psychology Press, 21–39.
- Hill, A. B., & Perkins, R. E. (1985). Towards a model of boredom. *British Journal of Psychology*, *76*, 235–240.
- Hoemann, K., Khan, Z., Feldman, M. J., Nielson, C., Devlin, M., Dy, J., ... & Quigley, K. S. (2020). Context-aware experience sampling reveals the scale of variation in affective experience. *Scientific reports*, *10*(1), 1-16.
- Hunter, A., & Eastwood, J. D. (2018). Does state boredom cause failures of attention? Examining the relations between trait boredom, state boredom, and sustained attention. *Experimental Brain Research*, *236*(9), 2483-2492.
- Jeronimus, B.F., Laceulle, O.M. (2017). Frustration. In V. Zeigler Hill, & T. K. Shackelford (Eds.), *Encyclopedia of personality and individual differences*. New York: Springer.
- Katahira, K., Yamazaki, Y., Yamaoka, C., Ozaki, H., Nakagawa, S., & Nagata, N. (2018). EEG correlates of the flow state: A combination of increased frontal theta and moderate frontocentral alpha rhythm in the mental arithmetic task. *Frontiers in Psychology*, *9*, 300.
- Keltner, D., & Gross, J. J. (1999). Functional Accounts of Emotions. *Cognition & Emotion*, *13*(5), 467-480.
- Keltner, D., & Haidt, J. (1999). Social Functions of Emotions at Four Levels of Analysis. *Cognition & Emotion*, *13*(5), 505-521.
- Keltner, D., Haidt, J., & Shiota, M. N. (2006). Social Functionalism and the Evolution of Emotions. *Evolution and Social Psychology*, 115-142.
- Kim, J., Seo, J., & Laine, T. H. (2018). Detecting boredom from eye gaze and EEG. *Biomedical Signal Processing and Control*, *46*, 302-313.
- Klapp, O. (1986). *Overload and boredom: Essays on the quality of life in the information society*. Connecticut: Greenwood Press.

- Koster, E. H., Crombez, G., Van Damme, S., Verschuere, B., & De Houwer, J. (2004). Does imminent threat capture and hold attention? *Emotions, 4*, 312–317.
- Kreutzer, J. S., Seel, R. T., & Gourley, E. (2001). The prevalence and symptom rates of depression after traumatic brain injury: a comprehensive examination. *Brain injury, 15*(7), 563-576.
- Kroes, S. (2005). Detecting boredom in meetings (pp. 1–5). Enschede: University of Twente.
- Kruglanski, A. W., Thompson, E. P., Higgins, E. T., Atash, M. N., Pierro, A., Shah, J. Y., & Spiegel, S. (2000). To "do the right thing" or to "just do it": Locomotion and assessment as distinct self-regulatory imperatives. *Journal of Personality and Social Psychology, 79*(5), 793–815. <https://doi.org/10.1037/0022-3514.79.5.793>
- Kurzban, R., Duckworth, A., Kable, J. W., & Myers, J. (2013). An opportunity cost model of subjective effort and task performance. *Behavioral and Brain Sciences, 36*(6), 661-679.
- Lench, H. C., Bench, S. W., Darbor, K. E., & Moore, M. (2015). A functionalist manifesto: Goal-related emotions from an evolutionary perspective. *Emotion Review, 7*(1), 90-98.
- Levenson, R. W. (1994). Human Emotions: A Functional View. In P. Ekman & R. Davidson, (Eds.), *The Nature of Emotion: Fundamental Questions*. New York: Oxford University Press, 123–126.
- Levin, J. (2018). Functionalism. In E. N. Zalta, *The Stanford Encyclopedia of Philosophy* (Fall 2018 Edition). <https://plato.stanford.edu/archives/fall2018/entries/functionalism>
- Lewinsky, H. (1943). Boredom. *British Journal of Educational Psychology, 13*, 147–152.
- Lhommet, M., & Marsella, S. C. (2015). Expressing emotion through posture and gesture. In R. Calvo, S. D'Mello, J. Gratch, & A. Kappas (Eds.), *The Oxford handbook of affective computing* (pp. 273–285). Oxford and New York: Oxford University Press.
- Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Feldman Barrett, L. (2012). The brain basis of emotion: A meta-analytic review. *Behavioral and Brain Sciences, 35*, 121–143.
- London, H., & Monello, L. (1974). Cognitive manipulation of boredom. In H. London & R. Nisbett (Eds.), *Thought and feeling* (pp. 44–59). Chicago, IL: Aldine.

- London, H., Schubert, D. S., & Washburn, D. (1972). Increase of autonomic arousal by boredom. *Journal of Abnormal Psychology, 80*, 29–36.
- Lundberg, U., Melin, B., Evans, G. W., & Holmberg, L. (1993). Physiological deactivation after two contrasting tasks at a video display terminal: Learning vs. repetitive data entry. *Ergonomics, 36*, 601–611.
- Maddi, S. R. (1970). The search for meaning. In W. J. Arnold & M. M. Page (Eds.), *The Nebraska symposium on motivation* (pp. 134–183). Lincoln: University of Nebraska Press.
- Mann, S., & Robinson, A. (2009). Boredom in the lecture theatre: An investigation into the contributors, moderators, and outcomes of boredom amongst university students. *British Educational Research Journal, 35*, 243–258.
- Malkovsky, E., Merrifield, C., Goldberg, Y., & Danckert, J. (2012). Exploring the relationship between boredom and sustained attention. *Experimental Brain Research, 221*(1), 59–67.
- Martarelli, C., Wolff, W., & Bieleke, M. (2021). Bored by bothering: A cost-value approach to pandemic boredom. *Humanities & Social Sciences Communications, 8*: 218.
- Martin, M., Sadlo, G., & Stew, G. (2006). The phenomenon of boredom. *Qualitative Research in Psychology, 3*(3), 193–211.
- Meagher, R. K., & Mason, G. J. (2012). Environmental enrichment reduces signs of boredom in caged mink. *PLoS One, 7*(11), e49180.
- Melton, A. M., & Schulenberg, S. E. (2009). A confirmatory factor analysis of the boredom proneness scale. *The Journal of Psychology, 143*, 493–508.
- Mercer-Lynn, K. B., Bar, R. J., & Eastwood, J. D. (2014). Causes of boredom: The person, the situation, or both?. *Personality and Individual Differences, 56*, 122–126.
- Merrifield, C., & Danckert, J. (2014). Characterizing the psychophysiological signature of boredom. *Experimental brain research, 232*(2), 481–491.
- Mikulas, W. L., & Vodanovich, S. J. (1993). The essence of boredom. *Psychological Record, 43*, 3–12.



- Mills, C., & Christoff, K. (2018). Finding consistency in boredom by appreciating its instability. *Trends in Cognitive Sciences*, 22(9), 744-747.
- Mugon, J., Struk, A., & Danckert, J. (2018). A failure to launch: Regulatory modes and boredom proneness. *Frontiers in psychology*, 9, 1126.
- Neander, K. (2017). Functional Analysis and the Species Design. *Synthese*, 194 (4), 1147– 68.
- Nederkoorn, C., Vancleef, L., Wilkenhöner, A., Claes, L., & Havermans, R. C. (2016). Self-inflicted pain out of boredom. *Psychiatry Research*, 237, 127–132.
- Niedenthal, P. M., & Brauer, M. (2012). Social Functionality of Human Emotion. *Annual Review of Psychology*, 63, 259-285. Nisbet, R. (1982). Boredom. *Commentary*, 74(3), 48.
- Oatley, K., & Jenkins, J. M. (1992). Human Emotions: Function and Dysfunction. *Annual Review of Psychology*, 43(1), 55-85.
- Oddy, M., Humphrey, M., & Uttley, D. (1978). Subjective impairment and social recovery after closed head injury. *Journal of Neurology, Neurosurgery & Psychiatry*, 41(7), 611-616.
- O'Brien, W. (2014). Boredom. *Analysis* 74, 236–244.
- O'Hanlon, J. F. (1981). Boredom: Practical consequences and a theory. *Acta Psychologica*, 49, 53–82.
- Oswald, I. (1962). The EEG of sleep. In I. Oswald (Ed.), *Sleeping and waking: Physiology and psychology* (pp. 35–41). Amsterdam: Elsevier.
- Pattyn, N., Neyt, X., Henderickx, D., & Soetens, E. (2008). Psychophysiological investigation of vigilance decrement: Boredom or cognitive fatigue? *Physiology & Behavior*, 93, 369–378.
- Pekrun, R., Goetz, T., Daniels, L. M., Stupnisky, R. H., & Perry, R. P. (2010). Boredom in achievement settings: Exploring control-value antecedents and performance outcomes of a neglected emotion. *Journal of Educational Psychology*, 102, 531–549.
- Pekrun, R., Hall, N. C., Goetz, T., & Perry, R. P. (2014). Boredom and academic achievement: Testing a model of reciprocal causation. *Journal of Educational Psychology*, 106(3), 696-710.
- Perone, S., Weybright, E. H., & Anderson, A. J. (2019). Over and over again: Changes in frontal EEG asymmetry across a boring task. *Psychophysiology*, 56(10), e13427.

- Pfattheicher, S., Lazarević, L. B., Westgate, E. C., & Schindler, S. (2020). On the relation of boredom and sadistic aggression. *Journal of Personality and Social Psychology*. Advance online publication. <https://doi.org/10.1037/pspi0000335>
- Polger, T. W. (2012). Functionalism as a philosophical theory of the cognitive sciences. *Wiley Interdisciplinary Reviews: Cognitive Science*, 3(3), 337-348.
- Plutchik, R. (2001). The Nature of Emotions. *American Scientist*, 89(4), 344-350.
- Raffaelli, Q., Mills, C., & Christoff, K. (2018). The knowns and unknowns of boredom: a review of the literature. *Experimental brain research*, 236(9), 2451-2462.
- Ralph, B. C., Onderwater, K., Thomson, D. R., & Smilek, D. (2017). Disrupting monotony while increasing demand: benefits of rest and intervening tasks on vigilance. *Psychological research*, 81(2), 432-444.
- Gomez-Ramirez, J., & Costa, T. (2017). Boredom begets creativity: A solution to the exploitation–exploration trade-off in predictive coding. *Biosystems*, 162, 168-176.
- Sander, D., Grandjean, D., & Scherer, K. R. (2018). An appraisal-driven componential approach to the emotional brain. *Emotion Review*, 10(3), 219-231.
- Sangal, R. B., & Sangal, J. M. (2015). Use of EEG Beta-1 power and theta/Beta ratio over Broca's area to confirm diagnosis of attention deficit/hyperactivity disorder in children. *Clinical EEG and Neuroscience*, 46(3), 177–182.
- Scerbo, M. W. (1998). What's so boring about vigilance? In R. R. Hoffman, M. F. Sherrick, & J. S. Warm (Eds.), *Viewing psychology as a whole: The integrative science of William N. Dember* (pp. 135–166). Washington, DC: American Psychological Association.
- Scherer, K. R. (2013). Nonlinguistic vocal indicators of emotion and psychopathology. In C. Izard (Ed.), *Emotions in Personality and Psychopathology* (pp. 495–529). New York and London: Plenum Press.
- Scherer, K. R., & Ellgring, H. (2007). Multimodal expression of emotion: Affect programs or componential appraisal patterns? *Emotion*, 7(1), 158–171.
- Steinberger, F., Moeller, A., &

- Schroeter, R. (2016). The antecedents, experience, and coping strategies of driver boredom in young adult males. *Journal of Safety Research*, *59*, 69-82.
- Shaw, S. M., Caldwell, L. L., & Kleiber, D. A. (1996). Boredom, stress and social control in the daily activities of adolescents. *Journal of Leisure Research*, *28*(4), 274-292.
- Siegel, E. H., Sands, M. K., van den Noortgate, W., Condon, P., Chang, Y., Dy, J., . . . Barrett, L. F. (2018). Emotion fingerprints or emotion populations? A meta-analytic investigation of autonomic features of emotion categories. *Psychological Bulletin*, *144*(4), 343–393. doi:10.1037/bul0000128
- Smith, A & Page, D. (2015). U.S. smartphone use in 2015. *PewResearch Internet Project*. Retrieved July 03, 2020. <https://www.pewresearch.org/internet/2015/04/01/us-smartphone-use-in-2015/>
- Steinberger, F., Moeller, A., & Schroeter, R. (2016). The antecedents, experience, and coping strategies of driver boredom in young adult males. *Journal of Safety Research*, *59*, 69-82.
- Struk, A. A., Carriere, J. S. A., Cheyne, J. A., & Danckert, J. (2017). A short boredom proneness scale: Development and psychometric properties. *Assessment*, *24* (3), 346–359.
- Struk, A. A., Scholer, A. A., & Danckert, J. (2021). Perceptions of Control Influence Feelings of Boredom. *Frontiers in Psychology*, *12*, 2698.
- Struk, A. A., Scholer, A. A., & Danckert, J. (2016). A self-regulatory approach to understanding boredom proneness. *Cognition and Emotion*, *30*(8), 1388-1401.
- Struk, A. A., Scholer, A. A., Danckert, J., & Seli, P. (2020). Rich environments, dull experiences: how environment can exacerbate the effect of constraint on the experience of boredom. *Cognition and Emotion*, *34*(7), 1517-1523.
- Svendsen, L. (2019). Animal Boredom. J. Ros Velasco (Ed.), In *Boredom Is in Your Mind. A Shared Psychological-Philosophical Approach* (pp. 135-147). Cham: Springer.
- Tabatabaie, A. F., Azadehfar, M. R., Mirian, N., Noroozian, M., Yoonessi, A., & Yoonessi, A. (2014). Neural correlates of boredom in music perception. *Basic and Clinical Neuroscience*, *5*, 259–266.

- Tam, Katy, Wijnand A. P. Van Tilburg, Christian Chan, Eric Igou, and Hakwan Lau. In press. "Attention Drifting In and Out: The Boredom Feedback Model." *Personality and Social Psychology Review*. Advance Online Publication. <https://doi.org/10.1177/10888683211010297>.
- Thackray, R. I., Bailey, J. P., & Touchstone, R. M. (1977). Physiological, subjective, and performance correlates of reported boredom and monotony while performing a simulated radar control task. In R. R. Mackie (Ed.), *Vigilance: Theory, operational performance and physiological correlates* (pp. 203–216). New York, NY: Plenum.
- The National Center on Addiction and Substance Use. (2003). Report on Teen Cigarette Smoking and Marijuana Use. Retrieved July 03, 2020. <https://www.centeronaddiction.org/addiction-research/reports/report-teen-cigarette-smoking-and-marijuana-use>
- Todman, McWelling. in press. Boredom Mismanagement and Attributions of Social and Moral Costs. In A. Elpidorou (Ed.), *The Moral Psychology of Boredom*. London: Rowman & Littlefield.
- Todman, McWelling. 2003. Boredom and Psychotic Disorders: Cognitive and Motivational Issues. *Psychiatry: Interpersonal and Biological Processes* 66(2): 146-67.
- Tooby, J. & Cosmides, L. (2008) The Evolutionary Psychology of the Emotions and their Relationship to Internal Regulatory Variables. In M. Lewis & J.M. Haviland-Jones (Eds.). *Handbook of Emotions, 3rd ed.* New York: Guilford Press, 103-129. Todman, M. (2003). Boredom and psychotic disorders: Cognitive and motivational issues. *Psychiatry*, 66, 146–167.
- Ulrich, M., Keller, J., Hoenig, K., Waller, C., & Grön, G. (2014). Neural correlates of experimentally induced flow experiences. *Neuroimage*, 86, 194-202.
- Van Damme, S., Crombez, G., & Lorenz, J. (2007). Pain draws visual attention to its location: Experimental evidence for a threat-related bias. *Journal of Pain*, 8, 976–982.
- van Hooft, E. A., & van Hooff, M. L. (2018). The state of boredom: Frustrating or depressing?. *Motivation and Emotion*, 1-16.
- Van Tilburg, W. A., & Igou, E. R. (2011). On boredom and social identity: A pragmatic meaning-regulation approach. *Personality and Social Psychology Bulletin*, 37, 1679–1691.

- Van Tilburg, W. A., & Igou, E. R. (2012). On boredom: Lack of challenge and meaning as distinct boredom experiences. *Motivation and Emotion*, 36(2), 181–194.
- Van Tilburg, W. A., & Igou, E. R. (2016). Going to political extremes in response to boredom. *European Journal of Social Psychology*, 46(6), 687–699.
- Van Tilburg, W. A., & Igou, E. R. (2017a). Boredom begs to differ: Differentiation from other negative emotions. *Emotion*, 17(2), 309–322.
- Van Tilburg, W. A., & Igou, E. R. (2017b). Can boredom help? Increased prosocial intentions in response to boredom. *Self and Identity*, 16(1), 82–96.
- Van Tilburg, W. A., Igou, E. R., & Sedikides, C. (2013). In search of meaningfulness: Nostalgia as an antidote to boredom. *Emotion*, 13(3), 450–461.
- Vodanovich, S. J. (2003). Psychometric measures of boredom: A review of the literature. *The Journal of Psychology*, 137(6), 569–595.
- Vogel-Walcutt, J. J., Fiorella, L., Carper, T., & Schatz, S. (2012). The definition, assessment, and mitigation of state boredom within educational settings: A comprehensive review. *Educational Psychology Review*, 24(1), 89–111.
- Wallace, J. C., Vodanovich, S. J., & Restino, B. M. (2003). Predicting cognitive failures from boredom proneness and daytime sleepiness scores: An investigation within military and undergraduate samples. *Personality and Individual Differences*, 34(4), 635–644.
- Wallbott, H. G. (1998). Bodily expression of emotion. *European Journal of Psychology*, 28, 879–896.
- Watt, J. D. (1991). Effect of boredom proneness on time perception. *Psychological Reports*, 69(1), 323–327.
- Wemelsfelder, F. (1985). Animal boredom: is a scientific study of the subjective experiences of animals possible?. In M. W. Fox & L. D. Mickley (Eds.), *Advances in Animal Welfare Science 1984* (pp. 115–154). Dordrecht: Springer.

- Wemelsfelder, F., 1991. Animal boredom: do animals miss being alert and active? In: M.C. Appleby, R.I. Horrell, J.C. Petherwick and SM. Rutter (Eds.), *Applied Animal Behaviour: Past, Present and Future* (pp. 120-123.). Potters Bar, UK: U.F.A.W.
- Wemelsfelder, F. (2005). Animal boredom: Understanding the tedium of confined lives. In F. McMillan (Ed.), *Mental Health and Well-Being in Animals* (pp. 77-91). Oxford, UK: Blackwell.
- Westgate, E. C. (2020). Why Boredom is Interesting. *Current Directions in Psychological Science*, 29(1), 33-40.
- Westgate, E. C., & Wilson, T. D. (2018). Boring thoughts and bored minds: The MAC model of boredom and cognitive engagement. *Psychological Review*, 125(5), 689–713.
- Wilson, T. D., Reinhard, D. A., Westgate, E. C., Gilbert, D. T., Ellerbeck, N., Hahn, C., Brown, C. L., & Shaked, A. (2014). Social psychology. Just think: the challenges of the disengaged mind. *Science*, 345, 75–77.
- Witowska, J., Schmidt, S., & Wittmann, M. (2020). What happens while waiting? How self-regulation affects boredom and subjective time during a real waiting situation. *Acta Psychologica*, 205, 103061.
- Wojtowicz, Z., Chater, N., & Loewenstein, G. (2021). Boredom and flow: An opportunity cost theory of attention-directing motivational states. *Available at SSRN 3339123*.
- Wolff, W., & Martarelli, C. (2020). Bored into depletion? Towards a tentative integration of perceived self-control exertion and boredom as guiding signals for goal-directed behavior. *Perspectives on Psychological Sciences*. Advance Publication.
- Wolff, W., Martarelli, C. S., Schüler, J., & Bieleke, M. (2020). High boredom proneness and low trait self-control impair adherence to social distancing guidelines during the COVID-19 pandemic. *International journal of environmental research and public health*, 17(15), 5420.
- Wright, L. (1973). Functions. *Philosophical Review*, 82(2), 139-168.
- Wyatt, S., Fraser, J. A., & Stock, F. G. (1929). The Effects of Monotony in Work: A Preliminary Study. *Industrial Health Research Board*, 56, 47.

- Yakobi, O., & Danckert, J. (2021). Boredom proneness is associated with noisy decision-making, not risk-taking. *Experimental Brain Research*, 239, 1807-1825.
- Yakobi, O., Boylan, J., & Danckert, J. (2021). Behavioral and electroencephalographic evidence for reduced attentional control and performance monitoring in boredom. *Psychophysiology*, e13816.
- Yao, V. (in press). Boredom as a Cognitive Attitude. In A. Elpidorou (Ed.), *The Moral Psychology of Boredom*. London: Rowman & Littlefield.
- Yu, R. (2016). The Neural Basis of Frustration State. In J. R. Absher (Ed.), *Neuroimaging Personality, Social Cognition, and Character* (pp. 223-243). Amsterdam: Academic Press.
- Zhao, C., Zhao, M., Liu, J., & Zheng, C. (2012). Electroencephalogram and electrocardiograph assessment of mental fatigue in a driving simulator. *Accident Analysis & Prevention*, 45, 83–90.
- Zuckerman, M. (1979). *Sensation seeking: Beyond the optimal level of arousal*. Hillsdale: Erlbaum.