

BRIEF ARTICLE



Rich environments, dull experiences: how environment can exacerbate the effect of constraint on the experience of boredom

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ABSTRACT

We examined the hypothesis that boredom is likely to occur when opportunity costs are high; that is, when there is a high potential value of engaging in activities other than the researcher-assigned activity. To this end, participants were either placed in a room with many possible affordances (e.g. a laptop, puzzle, etc.; *affordances condition*; $n = 121$), or they were ushered into an empty room (*control condition*; $n = 107$). In both conditions participants were instructed to entertain themselves with only their thoughts (hence, participants in the affordances condition were to refrain from engaging with the available options). As predicted, participants in the affordances condition reported higher levels of boredom compared with those in the control condition. Results suggest that under some conditions, environments that afford alternative activities may be *more* boring than those that are void of such activities.

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Boredom is a ubiquitous human experience. Indeed, research suggests that a typical high-school student will experience some level of boredom – up to 36% of the time – in any given day (Goetz et al., 2014), and that 91% of North American youth experience boredom (The National Center on Addiction and Substance Abuse, 2003). In addition, boredom is a consequential experience linked to a slew of negative cognitive, affective, and behavioural outcomes, with inattention, depression, and substance use forming just the tip of the iceberg (for reviews see Eastwood et al., 2012; Farmer & Sundberg, 1986; Westgate & Wilson, 2018). A thorough understanding of boredom and its antecedents is essential in the development of methods by which the consequences of boredom might be minimised, and hence, identifying such antecedents is of practical, as well as theoretical, importance. In the present study, our aim was to examine the recently theorised – yet currently untested – hypothesis that boredom results when opportunity costs are high; that is, when there is a high potential value of engaging in activities other

than one's current activity (Gomez-Ramirez & Costa, 2017; Kurzban et al., 2013).

Boredom is a negative emotional state commonly characterised by an inability to engage with a satisfying activity, coupled with the desire to engage in something other than what one is currently doing (Eastwood et al., 2012). Boredom is universally recognised to occur when we are stuck doing something we don't want to do, or when we find ourselves in circumstances wherein we don't know what to do (for review see Eastwood et al., 2012). This latter aspect of boredom – that we may be bored without knowing what it is that we want to do (or without wanting to do any of the currently available options for action) – highlights a possible role for boredom in prompting us to identify and engage in satisfying goal pursuits.

Functional accounts of boredom suggest there is more to the experience of boredom than merely failure to engage (Bench & Lench, 2013; Danckert et al., 2018; Elpidorou, 2018a). Broadly speaking, these accounts suggest that boredom is an emotion

that serves two functions. First, boredom informs us that the current situation is unsatisfactory in some way (most commonly represented by a lack of meaning, monotony, or inappropriate levels of challenge); second, it motivates us to alter ongoing activities or pursue new, potentially more-satisfactory goals (Elpidorou, 2018a, 2018b). According to this perspective, a situation is unsatisfactory (and hence, boring) when it is associated with *opportunity costs* (Kurzban et al., 2013); that is, the uncomfortable feeling of boredom signals that the potential value of engaging in alternative activities is high. Thus, according to the opportunity-cost framework, boredom is not solely a failure to engage, but it is also a self-regulatory signal that indicates that we could be more optimally engaged if we completed some other activity.¹

In the present study, we sought to test the opportunity-cost theory of boredom by determining whether exposing participants to potential affordances promotes the experience of boredom. Here, as per the Oxford dictionary's definition, we conceptualise "affordances" in terms of "a property of an object or an *aspect of the environment*, especially relating to its *potential utility*, which can be inferred from visual or other perceptual signals" ("Affordance" 2019; emphasis added.) To this end, we contrasted two circumstances, both of which involved instructing people to entertain themselves with only their thoughts. Whereas one group (control group) was placed in an empty room, the other (affordances group) was placed in a room containing various objects that afforded meaningful engagement. Critically, participants in both conditions were asked to refrain from engaging with anything in either environment. For empty room this amounted to staying seated, awake and having only your thoughts. We hypothesised that participants placed in a room with avenues for meaningful engagement would report greater levels of boredom than those placed in an empty room, presumably because such environments dramatically increase the opportunity costs associated with the primary task. Furthermore, given that boredom has been characterised as a state of wanting and is thought to motivate the individual to engage in a more satisfying activity, we examined whether the exposure to different environments also affected people's state of wanting to engage. We hypothesised that environments with many affordances would elicit a greater desire for engagement (i.e. increased wanting) than environments with no affordances. Finally, since we prevented people from

engaging in their environments, it seemed plausible that this manipulation would elevate feelings of frustration. However, we believed that our manipulation would primarily affect boredom – a state we believe is characterised by a failure to *launch* into goal pursuit (Mugon et al., 2018). In contrast, frustration is a state that arises when we encounter obstacles *during* goal pursuit (Dollard et al., 1939). Thus, we measured feelings of frustration and predicted that there would be no differences in frustration between the engaging and non-engaging environments as neither circumstance *impedes a goal in progress*.

Method

Pre-Registration. This study was preregistered on AsPredicted under the title of "The Role of Action Space on the Experience of Boredom under Constraints" (#2577) on January 16, 2017 (<http://aspredicted.org/p5b36.pdf>).

Participants. In a pilot study ($N=80$), the primary effect size (the effect of condition on reported boredom) was Cohen's $d=0.42$. Thus, to attain 80% power, a sample of 90 participants per condition would be needed. Two-hundred and twenty-eight undergraduates (184 females, mean age = 20.35, $SD=3.23$) participated in exchange for partial course credit. In terms of self-reported ethnicity, 41.9% identified as White/Caucasian, 21.1% as East Asian, 14.5% as South Asian, 5.7% as Middle Eastern, 4.8% as Southeast Asian, 3.1% as Black/African, 3.1% as West Indian/Caribbean, 2.6% as Hispanic, with 3.1% of the sample responding "other" or declining to indicate the ethnicity they identified with. In accordance with our pre-registration, we pre-selected participants who were not highly prone to boredom in order to maximise power.² Short Boredom Proneness Scale (Struk et al., 2017) was used to measure boredom proneness, and was administered at the beginning of each academic term as part of a larger survey used for pre-screening purposes. Participants were qualified to participate in our study if their SBPS score was no more than a quartile above the group median. Participants were randomly assigned to one of two experimental conditions. Data were collected throughout the 2017 academic year and into the winter term of 2018. We decided, a priori, to collect data from as many participants as needed to attain 90 rule-complying participants per condition (see Supplemental Material for compliance rules). This study received ethics

clearance from University of Waterloo Office of Research Ethics (ORE# 31108).

Procedure and experimental setup. Participants were either seated in (1) an empty room in which there was only a chair, an empty bookshelf, a chalk board with no chalk, a filing cabinet, and a desk (control condition) or (2) an engaging room in which, in addition to the items in the empty room, there were numerous objects with which participants could normally interact: chalk was added to the chalk board, a laptop computer in Firefox web-kiosk mode and a Google front page were opened, and a partially completed Lego car puzzle, a partly completed jig-saw puzzle, three sheets of blank paper, and a set of crayons were placed in the room (affordances condition). Participants in both conditions were instructed to refrain from engaging with their environment and to instead stay seated, remain awake, and entertain themselves with their thoughts for a 15-minute period. (To ensure that participants complied with this instruction, we placed a hidden camera – encased in a coffee mug; Lawmate Thermos Hidden DVR Spy Camera with 740p High Resolution – on top of a filing cabinet in the corner of the room.) Prior to the researcher's departure, participants were required to give their backpack and electronic devices to the researcher for the duration of the study (Wilson et al., 2014). After the 15-minute "just think" period, the researcher returned to administer a brief questionnaire, which was completed on a tablet. Participants responded to the following 3 questions: "Rate how bored you were over the last 15-minute period"; "Rate how frustrated you were over the last 15-minute period"; "Rate how much you wanted to do something over the last 15-minute period." Participants responded to all questions on a Likert scale ranging from, 1 ("Not At All") to 9 ("Extremely"). Prior to departure, participants were informed of the purpose of the experiment, and the use of video recording was disclosed and consent to review the video recording was obtained. Following each participant's departure, the video recording was reviewed by the researcher and the participant was deemed a rule-breaker if they did any of the following: stood up, fell asleep, or interacted with their environment (these exclusion criteria can be found in our preregistration; see Supplemental Material for detailed coding instructions). The exclusion criteria were determined, a priori, based on participant feedback in a pilot study in which some participants occasionally broke rules when placed in a room with objects that they were told to

refrain from engaging with. To compute the inter-rater reliability and to determine the final exclusions, following conclusion of data collection, two independent video coders reviewed the videos using the same coding instructions previously used by the experimenter staff during data collection (see Supplementary Material for detailed breakdown of coding results). Discrepancies between coders were resolved by having both coders meet and agree on a single coding outcome.

Results

Normality. All data analyses were conducted in R (R Core Team, 2015). Shapiro–Wilks tests of normality (Shapiro & Wilk, 1965) indicated that none of the study variables were normally distributed (all $ps < 0.05$). As such, non-parametric comparisons were conducted throughout. Independent-samples non-parametric comparisons were conducted using Wilcoxon's rank-sum test (Wilcoxon, 1945).³ Medians, first and third quartiles, means and standard deviations are reported to describe each variable. For all comparisons, p values (based on Mann–Whitney–Wilcoxon test), non-parametric effect sizes (Cliff's delta) and parametric effect sizes (Cohen's D ; assuming an independent samples t -test) are reported (Cliff, 1993; Cohen, 1988).

Condition Differences. Since a valid test of our hypothesis requires that participants follow our instructions, the following analyses were conducted on data from rule-followers only (Table 1 presents descriptive statistics for rule followers and for the full sample). A Bonferroni corrected family-wise alpha of $0.5/3 = 0.017$ was used for all comparisons. As predicted, participants reported greater levels of boredom in the affordances condition ($Med = 4$) than in the empty room (control condition; $Med = 3$; $p = 0.006$, Cliff's $D = 0.23$, Cohen's $D = 0.39$). There was no significant difference in wanting between the affordances condition ($Med = 5$) and the empty room ($Med = 4$; $p = 0.121$, Cliff's $D = 0.13$, Cohen's $D = 0.24$). Likewise, there was no significant difference in frustration between the affordances condition ($Med = 2$) and the empty room condition ($Med = 1$; $p = 0.066$, Cliff's $D = 0.15$, Cohen's $D = 0.24$).

ANCOVA. To assess discriminatory validity of our manipulation's effect on boredom, we tested whether the effect of our manipulation remained after controlling for frustration. Following inclusion of frustration as a co-variate, our manipulation continued to have a significant effect on boredom, $F(1, 179)$

Table 1. Descriptive statistics and condition differences for rule-compliers and full sample.⁵

	Control Condition <i>n</i> = 91 (108)			Affordances Condition <i>n</i> = 91 (121)			<i>p</i>	Cliff's <i>D</i>	Cohen's <i>D</i>
	Q1 Q2 Q3	<i>M</i>	<i>SD</i>	Q1 Q2 Q3	<i>M</i>	<i>SD</i>			
Boredom	2 3 5 2 3 5.25	3.62 3.66	2.16 2.20	3 4 6 3 4 6	4.47 4.46	2.20 2.31	.006 .006	0.23 0.21	0.39 0.35
Wanting	2 4 6 2 4 7	4.43 4.56	2.34 2.34	3 5 7.5 3 5 7	5.01 5.11	2.53 2.60	.121 .119	0.13 0.12	0.24 0.22
Frustration	1 1 2 1 1 2	1.79 1.80	1.20 1.25	1 2 3 1 2 3	2.12 2.31	1.53 1.71	.066 .005	0.15 0.22	0.24 0.34

Note. Statistics for the full sample are presented in bold; statistics for rule-followers are non-bolded. Q2 = median, Q1 = first quartile, Q3 = third quartile, *M* = mean, *SD* = standard deviation, *p* = significance value of Wilcoxon's rank-sum test

= 4.40, $p = .037$. In line with this analysis, we also wanted to test whether our manipulation uniquely affects boredom beyond its effect on wanting. Thus, we repeated this analysis, this time controlling for wanting. Following inclusion of wanting as a covariate, our manipulation continued to have a significant effect on boredom, $F(1, 179) = 4.80$, $p = .030$.

We found no significant effects of gender as a function of rule compliance (see Supplementary Material). Further exploratory analyses, including correlations between study variables and mediation analyses can be found in the Supplementary Material.

Discussion

Consistent with the opportunity-cost model of boredom (see also Kurzban et al., 2013), when participants were asked to refrain from engaging with the environment and instead entertain themselves with their own thoughts, those placed in a room with many options for engagement (affordances condition) reported higher levels of boredom than those placed in an empty room. This suggests that having a dearth of options for engagement (i.e. being in an empty room, with only your thoughts for entertainment) is in fact *less* boring than being exposed to (but unable to interact with) numerous options for engagement. Presumably, this occurs because the task of entertaining oneself with one's own thoughts is associated with greater opportunity costs in an environment that is rich in potentially valuable or engaging alternatives.

Boredom is characterised as a state of wanting coupled with an inability to engage in a satisfying activity (Eastwood et al., 2012). Consistently we observed a strong relationship between boredom

and wanting ($r = 0.77$; Supplementary Material). However, our manipulation did not have a significant effect on wanting alone. There are at least two possibilities for this null finding. First, the effect of our manipulation on wanting may have been substantially weaker than the effect on boredom making it more challenging to detect any influence on wanting with current design. Indeed, in the present study, we found preliminary evidence to suggest that exposure to alternative activities (i.e. increased opportunity costs) primarily affects boredom (beyond frustration or wanting), which precedes the desire to engage with the environment (see Supplementary Materials). This suggests that, any effect on wanting as a function of our manipulation may be secondary to the effect on boredom. Alternatively, we may fail to see a significant effect of our manipulation on wanting because boredom and wanting are independent; that is, an individual may become bored without experiencing an increase in wanting – an outcome that our manipulation may have inadvertently yielded. Under conditions of constraint, whether the effect of opportunity costs on wanting is weak, or whether boredom can be completely decoupled from wanting, is a line of inquiry worthy of investigation in future studies.

Since we regarded frustration as a state that arises when we encounter obstacles *during goal pursuit* – a condition that both of our rooms lacked since goals were explicitly not pursued – we predicted that frustration would be unaffected by our manipulation. We found that participants in the affordances condition did not report significantly higher levels of frustration than those in the empty room. Unlike boredom, most people reported relatively little to no frustration in both conditions (i.e. all scores were on the low end of the scale; Table 1). Nevertheless, a

further exploratory analysis indicated that wanting and boredom may contribute to feelings of frustration (see Supplementary Materials).

Our results dovetail well with functional theories of boredom that suggest that boredom signals dissatisfaction with the current situation and a desire to engage in a more satisfying activity (Elpidorou, 2018a, 2018b). These results are consistent with how we view trait-boredom proneness – a tendency to experience boredom more frequently and intensely (Farmer & Sundberg, 1986). Boredom-prone individuals may see options for engagement, but fail to effectively launch into them (Mugon et al., 2018). We also speculate that the mechanism by which the state of boredom is elevated when options for engagement are present but restricted (as in our affordances condition), is via the representation of increased opportunity costs. This notion is consistent with prior research showing that high-boredom-prone individuals are more likely to be assessment oriented – placing an emphasis on evaluating and comparing alternatives for action (Higgins et al., 2003; Kruglanski et al., 2000; Mugon et al., 2018; Struk et al., 2016). Presumably, this kind of fruitless rumination over the potential options for engagement makes the opportunity costs associated with many (typically not boring) situations salient. In the current experiment we did not find that boredom proneness moderated the effect of our manipulation on the experience of state boredom (see Supplementary Materials). Since this may be due to the fact that we pre-selected participants who were not highly prone to boredom (to ensure sufficient power), future research should investigate whether boredom proneness acts as a moderator of state boredom as a function of the presence or absence of options for action (i.e. affordances).

On a practical level, our results suggest, somewhat counterintuitively, that being exposed to many outlets for engagement may have its downsides. That is, in the presence of opportunity costs (in this case, alternative activities) our current activity becomes boring, and hence, sustaining attention on the activity will likely prove difficult. This is particularly problematic when attainment of an adequate outcome is highly dependent on maintenance of engagement, and disengagement is not a viable option. For example, a student with a cellphone in his pocket may become more bored with a lecture relative to his peers who do not have access to a cellphone. This is because the opportunity costs associated with the lecture are more salient when one is equipped with a device

that affords many alternative, satisfying activities. Despite the apparent opportunity cost, commitment to attending to the lecture material does not avail oneself of engaging in the satisfying alternative, and thus prevents the alleviation of boredom.⁴

Our findings have direct implications for reducing boredom in circumstances where opportunity-cost saliency is suspected as the primary cause. The solution for reducing boredom in such cases may be as simple as tailoring the environment in a way that limits access to, or eliminates the cues of, activities unrelated to the task of interest. In other words, the goal of such intervention should be to minimise the salience of opportunity costs associated with the primary task. This can be implemented as part of self-help programme, for example deciding not to bring your cellphone to a lecture or choosing to study in a location that is different from that in which you recreate. Alternatively, interventions may be implemented on an organisational level, for example, by encouraging students to leave their cellphones at home or in their locker.

Concluding remarks

In the present study, we found that the inability to engage with an environment that afforded many alternative activities promoted feelings of boredom and a desire to engage with the environment. These results corroborate the notion that activities characterised by high opportunity costs (i.e. presence of alternative activities with the potential to be more engaging than the primary task) contribute to the experience of boredom, which signals dissatisfaction with the current activity and a desire to engage in some alternative. Our findings suggest that in the presence of satisfying alternatives an activity may become boring, and hence, that boredom could be alleviated by eliminating exposure to activities that are irrelevant to the primary task. Moving forward, we suggest that research should examine the effectiveness of interventions aimed at minimising opportunity costs or its salience to combat boredom in ecologically valid contexts, such as workplace or classroom settings.

Open practices statement

The preregistration for this experiment can be accessed at <https://aspredicted.org/p5b36.pdf>. The materials, dataset generated and analysed during the current study, as well as the analysis script, are

available in the OSF repository https://osf.io/9j8uz/?view_only=3dc0221a888545c5ad93f15eb66b948a.

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Notes

1. We would like to note that evaluative judgements akin to those outlined by Kurzban and colleagues have been historically recognized to precede the desire or intention to pursue goals of high desirability (for review see Custers, 2009). Furthermore, although the boredom signal may motivate us to alter ongoing activities or pursue some other activity, it does not necessitate that an individual is able to respond to this signal effectively. Indeed, prior work demonstrates that trait boredom is characterized by a failure to launch into goal pursuit (Mugon et al., 2018). This work suggests that the failure to respond to the boredom signal may be a major factor that makes the boredom experience potent and apparent to an individual.
2. In pilot work, a condition effect was observed including all participants regardless of scores on the SBPS. However, analyses indicated that the effect was greater ($d = 0.66$) if highly boredom prone individuals (those whose SBPS scores were at least 34 or above 3rd quartile) were removed. Thus, we made an a priori decision to exclude these participants as a way to increase power.
3. In our pre-registration, we indicated that we would conduct a two-sample permutation (exact significance) t test if assumptions of normality were violated. However, we now realize that the Wilcoxon test is more appropriate. We report the results from both analyses here and note that results do not differ substantially and thus do not change any of our interpretations.
4. It is, however, important to note that access to alternative satisfying activities could help alleviate boredom in some contexts, such as those in which engagement is not necessary for task completion. The most common example of this would be waiting: waiting does not require sustained engagement and permits engagement in other satisfying alternatives, such as conversing with someone.
5. In our pre-registration, we indicated that a two-sample permutation (exact significance) t test would be conducted. Although we instead opted to use the Wilcoxon Ranked-Sum test, we report significance values from the originally planned analyses here: $p = .010$ (.011) for boredom; $p = .014$ (.085) for wanting; $p = .121$ (.101) for frustration. We also report results from a regular t -test: $p = .009$ (.008) for boredom; $p = .109$ (.096) for wanting; $p = .106$ (.010) for frustration.

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