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The hidden potential of boredom – How does the relative perception of boredom influence concentration and task performance?

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Abstract

As boredom in the workplace is an important factor with widespread consequences, research interest in this topic is very high. This paper proposes a way of decreasing workplace boredom and thereby the negative effects associated with it. Based on literature about contrast effects, this paper develops the hypothesis that contrast between boredom levels leads to higher or lower evaluations of task boredom in a subsequent cognitive task. In an online experiment, this theory was tested. The results show that the same task is perceived as less boring when preceded by a monotonous and unchallenging task. An opposite effect for highly interesting tasks could not be determined. In addition, it was found that the boredom induction is linked to significantly lower concentration and that both boredom and inattention decrease cognitive performance. As proposed, the performance influence of boredom transcended tasks, with task C boredom fully mediating the relationship between task 1 boredom and cognitive performance. Further insights and implications are discussed, including a possible bidirectional causal relationship between boredom and inattention. The results implicate that boredom can be deliberately influenced through contextual cues and task order to mitigate its disadvantages.

Keywords: Boredom; Productivity; Work design; Concentration; Contrast effects.

1. Introduction

Boredom is unpleasant, but by no means not a rare state. For western societies, boredom was even claimed “when college students in the United States are polled about their concerns and problems, money is on the top of the list and boredom is number two” (Mael & Jex, 2015). Bertrand Russel even joked that “half the sins of mankind” are owed to a fear of boredom (Russell, 1932). Especially the constant overstimulation through media and technology are assumed to increase boredom both in and outside the workplace, resulting in a “national attention deficit disorder” (Mael & Jex, 2015, p. 144). One study showed that students use their smartphone more when bored at work. However, once they put it down, they were even more bored with their work than before and quickly picked it up again (Dora, Hooff, Geurts, Kompier, & Bijleveld, 2021, pp. 4, 8). Aiming to control boredom, this paper explores whether a task be perceived as more boring if it is preceded by a highly interesting task and vice versa and whether these contrast effects mitigate any disadvantages of boredom.

Especially in the workplace boredom has become prevalent in the last decade. A 2016 study found 43% of workers to be bored and disengaged at work regularly, 52% even for the majority of their work week. Especially younger workers are affected by boredom, and those who experience boredom are twice as likely to leave their company in the short run (Udemy, 2016, pp. 1, 3). Other negative consequences of boredom at work job dissatisfaction (Reijseger et al., 2013, pp. 516–518), depression (van Hooff & van Hooft, 2014, p. 353), health problems (Harju, Hakanen, & Schaufeli, 2014 theft or abuse) (Bruursema, Kessler, & Spector, 2011, pp. 100–102; Metin, Taris, & Peeters, 2016, pp. 260–261; Spector et al., 2006, p. 455), low organizational commitment and turnover intention (Reijseger et al., 2013, pp. 516–518).

A study by Wilson et al. (2014, p. 76) showed that people would rather give themselves electric shocks than be bored with nothing to do – even though earlier in the study, they were willing to pay money in order to stop the shocks. This is a first indication that sensations are viewed differently in different contexts. The concept of psychological contrast is well-documented for other sensations, like intrinsic motiva-

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tion (Shin & Grant, 2019) or happiness (Brickman, Coates, & Janoff-Bulman, 1978), and in contrast to boredom, creativity (Agnoli, Vanucci, Pelagatti, & Corazza, 2018, p. 46ff; Mann & Cadman, 2014, p. 17ff; Preiss, Cosmelli, Grau, & Ortiz, 2016, p. 6) and convergent thinking (Gasper & Middlewood, 2014, p. 54) increase. Applying these insights on boredom, this paper explores whether the perception and strength of boredom can be influenced through the context it appears in. Based on gained insights, this paper proposes a new approach to prioritize tasks according to their boringness in order to minimize boredom through contrast effects and maximize performance among workflows.

The main goal of this thesis is to explore influence of task order on boredom empirically. Uniquely, this paper attempts to isolate boredom from other influence factors, allowing for specific exploration of boredom effects. In the first part of this paper, the definitions and causes of boredom are addressed, drawing from psychology and organizational research in order to formulate nuanced and informed hypotheses. To explore this, an experiment was conducted, the methodology of which will be derived in Chapter 3. After analyzing and interpreting the results, possible limitations are discussed. To conclude the paper, implications for HR and managerial practice as well as further research approaches are proposed.

2. Background

The following chapter will explore thoroughly the different types and causes of boredom (Chapter 2.1), before turning towards the role of boredom in organizational studies (Chapter 2.2). The background is relevant for hypothesis development, methodology of the experiment and possible implications of the results. Afterwards, concepts of psychological contrast will be discussed and transferred onto the sensation of boredom (Chapter 2.3). Finally, the insights will be utilized in order to deduct multiple hypotheses (Chapter 2.4).

2.1. Definitions and dimensions of boredom

As an emotion, boredom is easy to identify, but it remains “a complex, difficult to define construct” (Goldberg, Eastwood, LaGuardia, & Danckert, 2011, p. 649). One of the first definitions goes back to 1903, when psychologist Theodor Lipps described boredom as “a feeling of unpleasure arising out of a conflict between a need for intense mental activity and lack of incitement to it, or inability to be incited” (Eastwood, Frischen, Fenske, & Smilek, 2012, p. 483f; Lipps, 1903, p. 278). Subsequent scholars (e.g. Greenson, 1953) build on this definition by adding that it is a passive state and people suffering from it are unable to define their desire. The defining feature of most definitions comes down to the suboptimal fit between current activity or cognitive requirements and desired activity or cognitive capacity.

Because the optimal fit could either be over- or underreached, there are two separate directions of boredom (Fisher, 1993, pp. 6–7). Qualitative underload describes the phenomenon when boredom is caused by overly simple, undemanding tasks where people underutilize their mental capacity or skills. An example for this could be a monotonous task like copying numbers. The opposite is boredom through qualitative overload, where people are overwhelmed by an overly hard task. An example could be reading an extraordinarily complicated piece of scholarly literature on a topic that the reader is unfamiliar with. Of course, both of these examples are fully subjective – what one person regards as dull might be relaxing to another. While characteristics like repetitiveness or monotony are related to boredom for most people (Loukidou, Loan-Clarke, & Daniels, 2009, p. 8f; O’Hanlon, 1981, p. 54), boringness is not inherent to any tasks and ultimately remains a subjective criterion decided by person-situation fit, or person-environment fit (Fisher, 1993, pp. 14–15).

Another distinction when it comes to boredom are state boredom and trait boredom (Loukidou et al., 2009, p. 7; Watson, Clark, & Carey, 1988, p. 347). State boredom refers to a transient, temporary experience of boredom during an activity, while trait boredom is an enduring, characteristic shown by individuals over a long period of time. These distinguishable affects are also known under the terms episodic and chronic boredom (Mael & Jex, 2015, p. 136), task-related and personality-related boredom (Haager, Kuhbandner, & Pekrun, 2018, pp. 2, 8) or boredom and boredom proneness (Drory, 1982, p. 144). Whenever the term boredom is used in this paper, it refers to state boredom unless specified otherwise. While different constructs can be classified as the opposite of boredom (e.g. fun, relaxation, enjoyment), this paper focusses on interest as the opposite sensation of boredom and uses the term accordingly (Hamilton, Haier, & Buchsbaum, 1984, pp. 184, 191).

There is no shortage of disagreements within boredom research. There is disagreement on whether boredom should be classified as an emotion, state or trait, and sometimes even whether it is affective or non-affective at all (Westgate & Steidle, 2020, p. 2ff.). However, the vast majority of researchers agree that boredom is negative in affect (Merrifield & Danckert, 2014, p. 481; van Tilburg & Igou, 2017, p. 309; Westgate & Steidle, 2020, p. 2). Similarly, researchers are divided whether boredom is low or high in arousal (Martin, Sadlo, & Stew, 2006, p. 196; Merrifield & Danckert, 2014, p. 481; van Tilburg & Igou, 2017, p. 317). Some researchers, however, argue that low and high arousal are not inconsistent, but the result of self-stimulation, and can thus both appear as the result of boredom (Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013, p. 69). Empirically comparing boredom to other emotions, C. A. Smith and Ellsworth (1985, p. 826) distinguished it as the only emotion that is unpleasant but does not require effort. Another empirical study by van Tilburg and Igou (2017, p. 313) showed that there are virtually no significant correlations to other negative emotions.

Theories on boredom are often based the extensively validated MAC model (Meaning and Attentional Components model) (Westgate & Wilson, 2018, pp. 693–696). According to this model, boredom forms along the two dimensions meaning and attention. The meaning component refers to whether the current activity fits with a person's goals and values, while the attentional component refers to the congruence of cognitive demands and cognitive resources. If the congruence is not given, attention is either not engaged at all or requires a conscious effort. Westgate and Wilson (2018, p. 693) paraphrase the two dimensions as willingness and ability to engage attention in a given activity. In line with Fisher (1993, pp. 6–7), the attentional component of the theory allows for both qualitative over- and underload (Westgate & Wilson, 2018, p. 695). Notably, the model allows for different profiles of boredom – meaning that either the meaning component, attentional component or any combination of the two can lead to boredom (Westgate & Wilson, 2018, p. 696).

The typology of boredom is important to understand the mechanisms behind boredom and thus to create a valid experiment. Additionally, the assessment can be utilized to define the precise scope of the experiment, i.e. focusing on state boredom. As boredom is a very broad and complex phenomenon, it is important to differentiate between types of boredom, both to manipulate and measure the outcomes related to boredom accurately.

2.2. Boredom in an organizational context

While the effects of boredom might be enhanced through overstimulation and technology usage, workplace boredom is hardly a new problem. Already in a 1978 study, up to 56% of workers expressed that they found their entire job boring, while 79-87% reported occasionally feeling bored at the job. As "boreouts" become more and more common these days (Lufkin, 2021) and workplace boredom is closely related to a number of counterproductive outcomes, research on the topic is highly relevant to practice. And it promises to become even more important: By 2025, it is expected that millennials make up 75% of the global workforce (Key Statistics about Milennials in the Workforce Firstup.io, 2021; Winograd & Hais, 2014, p. 2). This group is twice as susceptible to boredom (Udemy, 2016, p. 3), and 64% of them reported that they "would rather make 40,000 a year at a job they love than 100,000 a year at a job they think is boring" (White, 2014). Especially in organizations, boredom should thus be understood as a self-regulatory state and an "imperative towards meaning" (Barbalet, 1999, p. 633; Johnsen, 2016, p. 1410).

Note that workplace boredom refers to the frequency of state boredom at work. This is different from trait boredom in that the boredom is transient and does not necessarily perpetuate outside of work (Mael & Jex, 2015, p. 139). Precursors of boredom at work include both job and personal characteristics. Looking at job characteristics, repetitiveness and monotony are traditionally seen as major causes of boredom (Fisher, 1993, p. 6). Interestingly, workplace boredom has increased over the last decades, even though monotonous work has widely been automated or replaced (Mael & Jex, 2015, p. 142), which suggests that other causes exist. Next to the tasks themselves, low job resources and demands have been linked to workplace boredom (Metin et al., 2016, pp. 261–262), as have uncommunicative or absent coworkers, as socializing with coworkers is an important source of job satisfaction and relief from boredom. Without it, workers may opt for even less desirable relief behaviors (Fisher, 1987, pp. 11–12). Personal factors include boredom proneness, age, physical capacity, cognitive capacity (Drory, 1982, pp. 149–150) and many more. Of course, fit plays a big role, and while different fit concepts are complex and tend to interact with each other, it can be generalized that a better fit leads to higher job satisfaction, organizational commitment and intrinsic motivation (Kristof-Brown, Zimmerman, & B, 2005, p. 316; Kulik & Oldham, 1987, p. 288). For example, fit and preferences play a role in deciding whether a person finds monotonous jobs boring or enjoyable (Loukidou et al., 2009, p. 9; P. C. Smith, 1955, p. 328).

Next to fit, a special focus lies on intrinsic motivation. Ryan and Deci (2000) stated that "Perhaps no single phenomenon reflects the positive potential of human nature as much as intrinsic motivation", and connections between a lack of intrinsic motivation and workplace/leisure boredom have been established multiple times (Gkorezis & Kastritsi, 2017, p. 105; Shin & Grant, 2019, p. 9; Weissinger, Caldwell, & Bandalos, 1992, p. 323). This is in line with the MAC model, as intrinsic motivation is closely related, if not synonymous, with the meaning component. Thus, understanding intrinsic motivation is helpful in understanding workplace boredom. The job characteristic model by Hackman and Oldham (1976, p. 258) describes job factors influencing employee motivation. These include skill variety, task identity, task significance, autonomy and feedback. In line with this argument, perceived task autonomy itself was shown to be negatively correlated to workplace boredom, and boredom was experienced as especially frustrating when caused by low autonomy (van Hooft & van Hooff, 2018, p. 935).

These insights already carry a number of implications for managers who aim to minimize boredom in order to avoid the negative effects, like counterproductive work behavior and high turnover. For example, increasing any component of the job characteristics model should yield a positive effect on motivation and thus reduce boredom. A special focus should always lie on the fit of personal factors and job/task characteristics. Importantly for this paper, the outlined predictors of workplace boredom provide a framework on how boredom and interest can be manipulated in an experimental setting. At the same time, the insights underline that the manipulation of job factors cannot yield a generalizable manipulation, as fit and personal factors play a central role. This is relevant for the methodology, as it stresses the need to control for variation in what is considered boring.

2.3. Psychological contrast of sensations

While personal and task characteristics do affect the perception of tasks, they are not always the only factors at play. Another important factor can be the context of a task. When conceptualizing work, more often than not, it consists of multiple, sequential tasks (Ilgen & Hollenbeck, 1991, p. 173).

In organizational research, tasks are usually treated as single entities with a start and an end. It is rarely considered whether a task influences another task by contrast. For example, an upcoming unpleasant task might lead to procrastination on the current task, no matter how pleasant it is. Even when tasks are not directly dependent on each other, can still be interdependent.

Assimilation and contrast effects are well-known psychological phenomena that can be applied to a number of areas (Herr, Sherman, & Fazio, 1983, pp. 325–327; Sherif, Taub, & Hovland, 1961). According to the concept, stimuli are judged relative to a reference point, and high differences between stimulus and reference point are perceived stronger than they actually are (contrast effects), while minor differences lead to a convergence (assimilation effects). Examples for this have been found in many different areas, be it soft drinks tasting sweeter when compared to low-sucrose drinks (Riskey, Parducci, & Beauchamp, 1979, pp. 172–173) or candidates in job interviews (Wexley, Yukl, Kovacs, & Sanders, 1972, p. 47). The chosen reference point is often influenced by the most recent comparable experience, so it can be influenced trough temporal order (Brickman et al., 1978, p. 918; Kahneman, Diener, & Schwarz, 1999, p. 15). Crucial for this paper, contrast effects do not only apply to physical stimuli, but also to affects. As Colvin, Diener, Pavot, and Allman (1991, p. 491) observe over multiple studies, "an extremely positive event will not necessarily make bad events seem worse, but an extremely positive event might lower the value of moderately good events". Famously, Brickman et al. (1978, pp. 920–921) found that lottery winners become used to their new pleasures rather quickly. Some more incidental findings already indicate that boredom is also affected by contrast effects. For example, after periods of high activity, workers tend to be more bored when faced with "sharp contrasts" (Fisher, 1993, p. 35). Finally, Wojtowicz, Chater, and Loewenstein (2021, pp. 5–6) opportunity-cost model of boredom proposes that people undergo endowment effects regarding their attention when provided with low reference points, as they expect an ongoing level of stimulation.

Shin and Grant (2019, pp. 4, 23) were able to empirically show contrast effects between intrinsic motivation and performance. In two experiments, a significant relationship was found between intrinsic motivation levels of two consecutive tasks. For performance, they found that high intrinsic motivation will lead to worse performance in an uninteresting follow-up task, but not in an interesting one. The outcome was mediated by boredom. Dora et al. (2021, pp. 10–11) find that smartphone breaks at work lead to subsequently higher boredom. These findings could be viewed as first indication that contrast effects influence the strength of experienced boredom.

The examples show that contrast effects are applicable to different affective states. As intrinsic motivation and boredom are closely related, especially the findings on motivation suggest that cross-task effects may apply to boredom as well. The exploration of contrast effects is the core of the research question and the practical implications. Furthermore, the definition of contrast effects and reference points are helpful for the experimental manipulation.

2.4. Formulation of hypotheses

The portrayed background goes a long way in showing the mental processes of boredom and its different dimensions. It also supplies first looks into the relationship between boredom, concentration and cognitive performance. Applying the concept of contrast effects to boredom and its consequences, multiple hypotheses will be developed.

First findings on contrast effects provide evidence that intrinsic motivation is influenced by contrast effects, and incidental evidence points at their existence for boredom as well. In practice, the experienced boredom of a moderately interesting task should thus be higher when preceded by a highly interesting task and lower when preceded by an uninteresting task, as it pronounces the person-environment fit or lack thereof.

> Hypothesis 1a: The boringness of a task will be higher when it is preceded by a significantly more interesting task.
>
> Hypothesis 1b: The boringness of a task will be lower when it is preceded by a significantly less interesting task.

Drawing from the literature on boredom, there is a close relationship with attention. Low concentration (inattention) can be a feature of boredom; however, it is not synonymous with it. Previously, attention and boredom have been examined as separate constructs (e.g. Hunter & Eastwood, 2018; Wilson et al., 2014), as they will in this paper. While no clear causal evidence of that has been presented yet, it should be expected that people are unable to concentrate when bored and that a relief of boredom leads to better concentration. While attention and boredom are often correlated as a result of overlap in measures (e.g. the attentional component of the MAC model), a boredom manipulation for the same task offers the unique chance to isolate the inattention variable. Later in this paper, the issue of causality will be discussed.

> Hypothesis 2a: When boredom is high, participants' concentration will be lower
>
> Hypothesis 2b: When boredom is low, participants' concentration will be higher

Lastly, the relationship between boredom and performance will be explored. It has been proposed before that boredom leads to generally lower task performance (Cummings, Gao, & Thornburg, 2016, p. 289). As first indication for this research, an early study among truck drivers indicated that boredom is negatively correlated to work effectiveness. This relationship was moderated by physical (e.g. age) and mental capacity (Drory, 1982, pp. 149–150). Just as for concentration, it is unclear whether boredom and cognitive performance are causally correlated to each other. When accounting for inattention, it is expected that boredom itself will decrease the ability and/or willingness to perform.

Hypothesis 3a: When boredom is high, performance in cognitive tasks will be lower

Hypothesis 3b: When boredom is low, performance in cognitive tasks will be higher

3. Methodology

In order to test the hypotheses, a randomized, controlled experiment was performed online, designed to mirror a laboratory experiment. Great care was taken to minimize disturbances to the variables examined while still resembling working conditions as true to life as possible. The experiment was conducted through the online platform Gorilla (www.gorilla.sc), which was validated regarding precision and accuracy of data collection (A. Anwyl-Irvine, Dalmaijer, Hodges, & Evershed, 2021; A. L. Anwyl-Irvine, Massonnié, Flitton, Kirkham, & Evershed, 2020). The platform hosted the tasks and the questionnaires of the experiment and documented the relevant experimental data. It also registered whether participants used a mobile or desktop device, so potential differences could be controlled for. Among all participants, a giveaway for three Amazon gift cards with a 15€ value was held in order to increase participation willingness. Submitting an email address for the giveaway was not mandatory and the results remained anonymous. As all of the participants were German, the language of the experiment was German as well. Instructions and questionnaires can be found in Appendix A.

3.1. Structure and groups

Participants were divided into three groups. To document the cross-task effects of boredom, the two treatment groups were primed with differing amounts of boredom. Group B-C completed a highly boring task first, followed by a moderately boring, task that was held constant. (Note that boringness is a subjective judgement. However, for better readability, tasks will be referred to as boring and interesting depending on which judgement they aimed for.) Group I-C followed the same structure as B-C, with the variation that the first task was supposed to be highly interesting. In analyses that included both task I and task B combined, they were referred to as task 1. The control group C completed only the constant, moderately interesting task C. This group had natural variety in what activities preceded the experiment and was added to register whether the effect only went in one direction. Following the tasks, every participant filled out a questionnaire, registering boredom, inattention and additional information.

3.2. Tasks

For the boring task B, a qualitative underload approach was chosen. Often, these are highly monotonous and passive tasks. A 2014 paper compared multiple boredom inductions across two experiments to identify the most reliable one (Markey, Chin, Vanepps, & Loewenstein, 2014, pp. 239–24. 243, 245). A digitalized peg turning task, based on Festinger and Carlsmith (Festinger & Carlsmith, 1959, p. 205), lead to the highest self-reported boredom in terms of both intensity and discreteness. Accordingly, it became the recommended induction. For the B-C treatment, this task was adopted. It consisted of eight peg icons, arranged in two rows of four. The participants were instructed to continuously click on the peg that was highlighted, after which it turned 90 degrees clockwise and another peg was randomly highlighted. The task went on for 5 minutes.

Treatment I-C was supposed to receive a task that was deemed interesting by the participants. In similar experiments, videos are often used to induce either boredom or interest in comparison tasks (Markey et al., 2014, p. 240). Especially high-paced videos like clips from action movies, are used to induce interest and increase arousal (Fahlman et al., 2013, p. 78; Hunter & Eastwood, 2018, p. 2486). A more active, similarly reliable interest induction could not be identified, so watching a video was chosen as task I. While video mood inductions can be short-lived (Drody, Ralph, Danckert, & Smilek, 2022, p. 11), they have been shown multiple times to be effective in inducing interest (Drody et al., 2022, p. 9; Hunter & Eastwood, 2018, p. 2488; Merrifield & Danckert, 2014, p. 284). For the experiment, 4 different clips were chosen, from which participants were allowed to pick one that sounded the most interesting to them. After choosing, they were able to change their decision and watch a different clip instead if desired. To increase the meaning component, participants were asked to remember the most important details. It could be argued that different clips could influence the results in different ways, however, there are multiple upsides to providing a choice. First off, it was expected to increase the intensity of interest, as not every person deems the same things as entertaining. Subjectivity could be a limiting factor in inducing interest, which the choice helped to mitigate. Furthermore, participants were given more autonomy when choosing, a factor shown to increase intrinsic motivation and interest (Hackman & Oldham, 1976, p. 258; Westgate & Wilson, 2018, p. 690). Choice was similarly utilized by Fahlman et al. (2013, p. 78), leading to a successful induction and an increase in task engagement. Finally, the questionnaire aimed to control for any disruptive effect that different videos could lead to, as it registered the perceived boredom specifically. Regression analyses with one dummy variable per video also confirmed no significant influence on the outcome measures. Thus, the variability in videos is expected to raise reliability, as it increases autonomy and evens out effects that could be rooted in the other aspects. The four videos were:

- A clip from the American sitcom The Office (Dir. Blitz, 2009), chosen for its high-energy humor and high quantity of jokes,
- a truck chase scene from the action movie Terminator 2 (Dir. Cameron, 1991), chosen for its high-paced action content,
- the trailer for Elvis (Dir. Luhrmann, 2022), chosen for its novelty and the prominent use of editing and music,

Table 1: Overview of the groups and structure

Stage	Group B-C	Group I-C	Group C
1	Boring Task B	Interesting Task I	/
2	Constant Task C	Constant Task C	Constant Task C
3	Questionnaires B, C and G	Questionnaires I, C and G	Questionnaires C and G

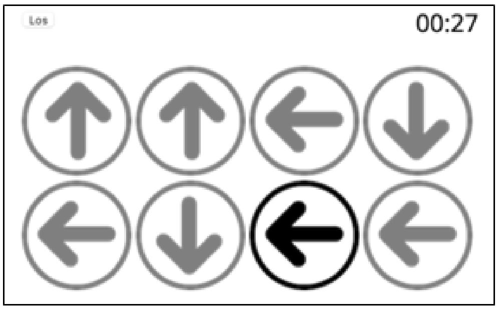

Figure 1: Peg turning task screen

and

- a collection of short videos from the app TikTok (TikTok, n.d.), chosen for their variety and their unexpected character.

The clips were all between 4 and 5 minutes long and chosen to work by themself, i.e. without any context. They were provided in both English and German (except the Tik Tok clip, which was not available in German).

The constant task C, shared among all groups, acted as the main base for comparison between groups. It was chosen to be moderately interesting and challenging while requiring cognitive capacity. For this, a 10x10 Schulte grid, also known as concentration grid, was used. The exercise has been shown to be resistant to practice effects (Greenlees, Thelwell, & Holder, 2006, p. 34). A Schulte grid is a square grid of differing dimensions with equal-sized cells, which is filled with two-digit numbers from 00 to X, in this case 99. Participants were instructed to click on the numbers in ascending order as quick as possible. This exercise requires visual scan speed and higher cognitive capacity will lead to better performance, as the locations of upcoming numbers can be remembered once they are seen. The main variable was the time needed to complete the table. Additionally, errors (i.e. clicking on the wrong number), reminders (i.e. when people forget the next number and click for a reminder) and the score after one minute were registered.

3.3. Questionnaire

After the groups completed their respective tasks, they filled out a questionnaire. This questionnaire had the purpose of registering the participants concentration and boredom along multiple dimensions. Other than the fact that groups B-C and I-C received a questionnaire about two tasks, these only differed in neglectable ways (e.g. when referencing the specific task). The questions on state boredom were drawn from the widely used Multidimensional State Boredom Scale (MSBS). The questions were translated and reworded to refer to the tasks at hand. The scale measures boredom on five subscales and has been tested extensively for validity and reliability ($\alpha = .94$) (Fahlman et al., 2013, pp. 76, 79). As excessively long questionnaires were found to decrease compliance (Sahlqvist et al., 2011, p. 5), the 29 questions in the original MSBS were reduced to 6. Three questions were drawn from the subscale disengagement and one each from high arousal, low arousal and time perception, as these were determined as the ones most applicable to the specific tasks (Fahlman et al., 2013, p. 73). The subscale inattention was separated to assess state concentration individually. Participants were asked whether they had difficulties concentrating, experienced mind wandering (Smallwood & Schooler, 2006, pp. 946–947) were easily distracted during the task. All answers were measured on a 5-point Likert Scale, with 5 indicating the highest boredom. The average of the disengagement, high/low arousal and time perception questions from the MSBS and the question on general boredom were averaged into a boredom score, used as the main variable to measure and process the participants' boredom. The boredom score was treated as interval data, as previously established for Likert scales in similar research (Wu & Leung, 2017, p. 5). Analogously, the three MSBS questions on inattention were combined into the inattention score, where a score of 1 indicated the best concentration and 5 indicates the most difficulties concentrating. Additionally, the groups were asked for their own belief whether they could've scored better in task 2 under different circumstances. Lastly, the

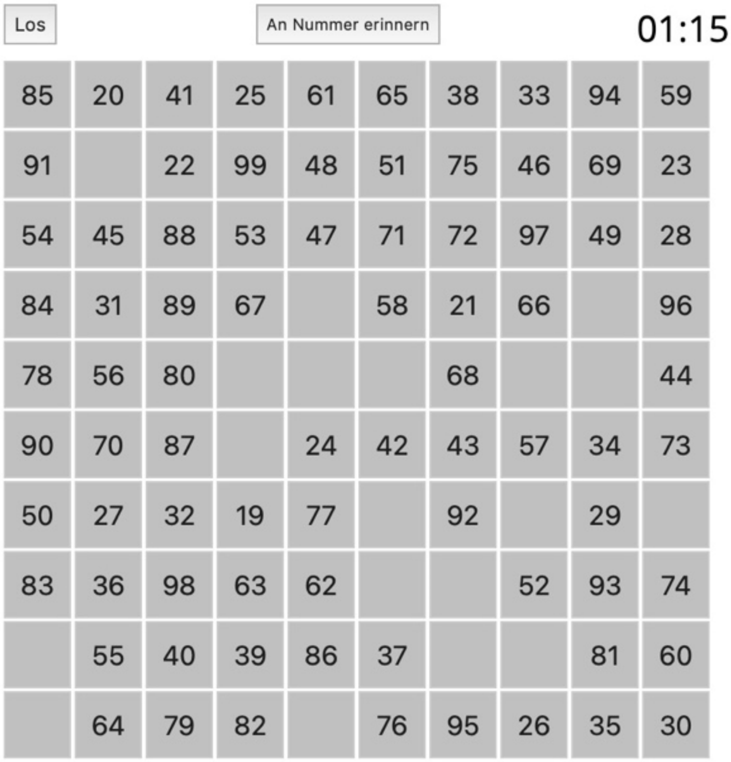

Figure 2: 10x10 Schulte table

candidates answered multiple questions for control purposes, including demographic questions (Age, gender and employment status), three questions from the Boredom Proneness Scale (BPS) to assess their trait boredom (Farmer & Sundberg, 1986, p. 6) and whether they actually watched the video for its full duration. The scale and questionnaires for each task can be found in Appendix A2 - Appendix A6.

3.4. Sample

The experiment was conducted with a representative sample of originally 84 participants. After reduction, discussed in the next section, 75 participants remained. 44 (58.67%) of the participants in the final sample were female, and the average age was 32.06 years (SD = 12.00). With 35 participants (46.67%) of the sample, students made up the highest share of the sample, closely followed by 31 (41.33%) employees. Participants were recruited through social and academic channels, for example by sharing the participation link via social media and in university-related groups. Participants were assigned to the groups fully randomized.

3.5. Validity

Additional measures were taken to attain the highest possible validity. For tasks B and I, the performance was documented in order to assess compliance. Participants who did not actually play the video for the full duration in task I and participants who did not click enough virtual pegs in task B were excluded from the sample. The lower limit for a participant to be included was 260 clicked pegs, below which a gap formed: All of the participants that were excluded clicked less than 100 pegs. Participants who declared in the questionnaire that they did not take part to the best of their abilities were also excluded from the sample before analysis began. Because this research aims to evaluate the cross-task influence of boredom, the groups were reduced by those participants for whom the mood induction was not successful. In group I-C, four participants were removed from consideration for a boredom score above 2.5. Five participants were removed from group B-C, with a boredom score of less than 3.5. 23 participants remained in group B-C, 26 in group I-C and 26 in group C (unchanged), leading to a final sample size of N = 75. As some questions were filled out incorrectly or not at all by some participants, the sample sizes of individual analyses may vary. For example, two participants did not enter their age correctly and were thus excluded from the sample for regressions that considered age as a coefficient.

4. Results

Before reduction, task B received a mean boredom score of 3.94 out of 5 (SD = .75). Task I achieved a mean boredom score of 2.23 (SD = .87), leading to a significant difference between groups, $t(56) = 7.965$, $p < .001$. After reduction, B-C received 4.19 (SD = .53) and I-C 1.94 (SD = .41). The difference between group means after reduction was still highly significant, t(47) = 16.595, p < .001. The fact that the difference was significant even before reduction is confirmation that the boredom induction was successful. Other than boredom proneness being negatively correlated to age, ρ = -.324, p < .01, no correlations among the control variables could be identified.

In the following analyses, a correlation coefficient will be calculated for each pair of outcomes in order to assess the general existence of a relationship. The correlation will be followed by one-sided t-tests to evaluate whether a significant effect exists for both groups and whether the hypothesis can be confirmed. To conclude each analysis, a regression model will be derived to control for other factors and identify strength and significance of treatment effects.

4.1. Cross-task effects on boredom

To explore H1a and H1b, the relevant measurement is the spread in boredom across tasks. If Hypothesis 1a were true, then task C should receive a lower boredom rating in group B-C than it did in the control group C. For group I-C, the score should be higher than that of the control group to confirm H1b. As the second task is the same for everyone task C, significant differences in reported boredom can only be attributed to the context that a task appears in (assuming normal distribution of task-person fit).

To assess whether a correlation between the boredom of both tasks exists independently of groups, Spearman's rho was calculated for the boredom scores of tasks 1 and C. This revealed a moderately strong negative correlation across both groups, ρ = -.308. The correlation is significant at p < .05. To calculate this correlation, the data for groups B-C and I-C was combined. This combined calculation provides first evidence for the contrast effect hypotheses. The correlation analysis shows that the boredom experienced through a previous task is a significant variable in assessing the boredom of the next task.

The correlation provides evidence for the general existence of cross-task effects; however, it does not consider the symmetry of the effect. In order to assess whether the effect goes in both directions, independent samples t-tests were performed. The tests showed that participants from group B-C (M = 2.106, SD = .905) experienced significantly less boredom during task C as those from the control group (M = 2.819, SD = .942), t(47) = -2.694, p < .01. The same way, they were significantly less bored than those from group I-C, (M = 2.901, SD = 1.07), t(47) = -2.783, p < .01. However, no significant difference could be identified between I-C and the control group, t(50) = .294, p = .385. This speaks to a one-sided effect in which only the high-boredom group B-C provides a significant negative effect on the follow-up tasks boredom.

To explore the relationship further and to control for other potential influences on task boredom, multiple linear regressions were run with Task C boredom as the dependent variable. The tested predictors of a first regression included task 1 boredom as well as boredom proneness, device type and the registered demographic factors (Appendix B1). Overall, the regression was not significant, R^2 = .274, F(8, 37) = 1.800, p = .120. A regression with less factors (Table 2) provided additional insights while being overall significant, R^2 = .236, F(3, 44) = 4.273, p < .01. Part of this regression were device type and gender; however, the only significant coefficient was the boredom score of the preceding task. The regression allows to disentangle the many factors at play and confirms that the significant cross-task effect persists when controlling for personal factors.

Understandably, the task itself remains the biggest influence on boredom. However, the models and tests outlined show a clear cross-task effect of previous boredom. As the pairwise comparison between groups only showed a significance difference for B-C, only Hypotheses 1a can be accepted. This already bears highly interesting insights on how boredom can potentially be reduced through self-organization and managerial intervention.

4.2. Effects on concentration

In order to assess the general relationship between boredom and inattention, Spearman's correlation coefficient was utilized to compare self-reported boredom score and self-reported inattention score. The calculations (Appendix B3) revealed high correlation coefficients of ρ = .388 between boredom and inattention for task 1 (p < .01) and ρ = .565 for task C (p < .001). This very high effect is in line with expectations, as boredom and attention are highly correlated constructs and can overlap, as described in chapter 2.1. When looking at the groups individually, the significance is sustained for group I-C. Here, the correlations are ρ = .515 for task I (p < .01) and ρ = .737 for task C (p < .001), which is even higher than those for the full sample. For group B-C, only the correlation for task C was significant at ρ = .489 (p < .05). The correlation for group C is not significant at ρ = .292 (p = .147). Even though the effects are not significant for every subgroup, the correlations show a clear effect between boredom and concentration, especially for cognitive task C.

Aiming to isolate the direction of the effect, t-tests were performed to compare the means of the task C inattention scores. Overall, group B-C (M = 1.62, SD = .83) reported the lowest levels of inattention during shared task C, followed shortly by the control group C (M = 1.85, SD = .76). The group with the highest reported inattention was group I-C (M = 2.37, SD = 1.26). The t-tests revealed a significant difference between task C inattention levels of I-C and the control group C, t(50) = 1.778, p < .05, suggesting that the interest induction of task I actively weakened concentration compared to the baseline. Similarly, B-C showed a significant difference from I-C, t(47) = 2.417; p < .01. However, B-C did not differ significantly from the control group, t(47) = -1.041, p = .15, meaning that the effect is considered one-sided. The t-tests can thus confirm H2a, but not H2b.

To validate the results and reveal any potential effects of other factors, a multiple linear regression was performed, employing the inattention score of task C as the dependent variable and controlling for demographic factors, device type

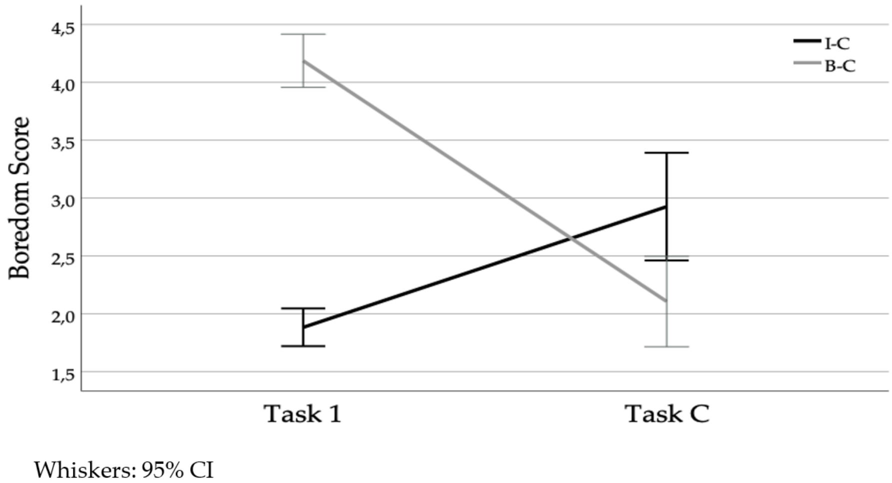

Figure 3: Cross-Task Boredom

Table 2: Regression on sequential Task Boredom

	R^2 (ΔR^2)	B	Std. Error	β	p
Model	.236				.008**
(Constant)		4.677	.610		<.001***
Task 1 Boredom	(.196)	-.417	.124	-.470	.002**
Gender (Female = 1)	(.060)	-.565	.304	-.250	.070
Device (Mobile = 1)	(.066)	-.667	.343	-.271	.058

*p < .05; **p < .01; ***p < .001; N = 48

Table 3: Regression on task C inattention

	R^2 (ΔR^2)	B	Std. Error	β	p
Model	.283				<.001***
(Constant)		.290	.374		.441
Task C Boredom	(.236)	.484	.101	.491	<.001***
Boredom Proneness	(.021)	.139	.097	.147	.155

* p < .05; ** p < .01; *** p < .001; N = 73

and boredom proneness. The first, extensive model was significant, $F(8, 62) = 3.095$, $p < .01$ but showed that there are no effects going out from control factors on inattention (Appendix B2). The most significant model (Table 3) included only state boredom and boredom proneness, $F(2, 70) = 13.832$, $p < .001$, $R^2 = .283$. The regression confirms the close relationship between boredom and inattention further and proves that the effects persist when controlling for personal factors. To test whether task C boredom acts as a mediator between task 1 boredom and task C inattention, a mediation analysis was performed. However, as a direct regression of task 1 boredom on task C inattention was not significant, $F(1, 47) = 1.226$, $R^2 = .069$, $p = .069$, a mediator relationship could not be concluded according to the model by Baron and Kenny (1986).

To better assess the causality between boredom and concentration, the inattention scores for task 1 and task C were correlated with each other. This assessment revealed no correlation, $\rho = -.007$, $p = .964$. The absence of a correlation indicates that the contrast effects and thus the significant differences between groups are explained by boredom only, as no direct contrast effects exist for concentration. This can be viewed as evidence that inattention was at least partially caused by boredom, as opposed to the other way around.

In conclusion, the exploration of H2 revealed a particularly high correlation between boredom and inattention for most groups, which is in line with expectations and the MAC model. It remains a controversial discussion among researchers whether boredom causes concentration failures or vice versa. While the regression does not allow for a causal

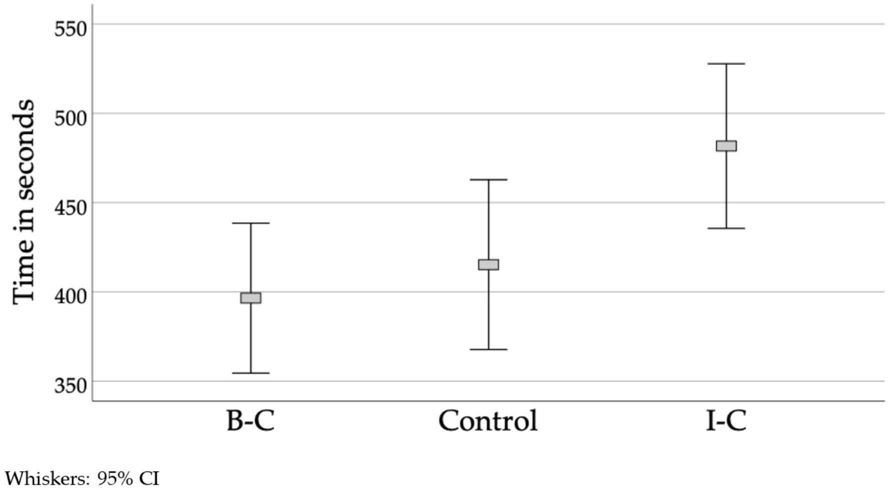

Figure 4: Arithmetic means of Schulte grid times

inference, the absence of contrast effects between inattention scores suggests the former. However, a bidirectional influence is possible and will be discussed later in this paper.

4.3. Effects on cognitive performance

To assess H3, the relationship between self-reported boredom and cognitive performance is observed. If H3a were correct, then group I-C should on average need more time to finish the grid than the control group C did. Analogously, to confirm H3b, the B-C participants should be able to complete it quicker than group C.

Aiming to confirm the internal consistency of the performance measure, correlations were performed among the primary measure (time) and the secondary measures. These showed that the number of errors was positively related to the time needed to complete the Schulte grid, ρ = .402, $p < .001$. Similarly, the progress after one minute was negatively correlated to the time needed, ρ = -.422, $p < .001$, indicating that the negative effect on performance is homogeneous throughout completion, as opposed to short-lived or late-emerging. Overall, these correlations indicate consistency among the performance measures.

Interestingly, multiple factors were correlated to cognitive performance during the Schulte grid exercise. Both boredom (ρ = .308) and inattention (ρ = .340) during task C were correlated with the time needed, $p < .01$, which is unsurprising considering the close relationship of the two factors. Additionally, boredom during the first task was by itself significantly correlated with the time needed ρ = .325, $p < .05$. Of the secondary performance measures, two were correlated with task C inattention: the achieved Schulte grid score after one minute was positively correlated with them, ρ = -.228, $p < .05$, which is consistent with the overall measure. Additionally, inattention correlated to the number of times that participants needed to be reminded of the next number, ρ = .258, $p < .05$. These two correlations combined with the higher correlation suggest a close relationship between boredom, inattention and cognitive performance. An overview of correlations can be found in Appendix B4.

Independent samples t-tests were performed for the groups in order to assess the differences in performance (Figure 4). The tests corroborated the results from the correlations, showing a clear significant distinction between the means of group B-C (M = 396,52, SD = 97,074) and I-C (M = 481.65, SD = 114,079), t(47) = 2.794, $p < .01$. The difference between the two groups was close to 90 seconds. The control group C (M = 415.27, SD = 117,663) did not differ significantly from B-C, t(47) = .604, p = .275. However, with more than 60 seconds difference, it did differ from I-C, t(50) = 2.065, $p < .05$. As group I-C was found to experience more boredom during task C, these results confirm H3a, while H3b cannot be confirmed through the given data.

An explanatory regression was performed in order to control for any additional factors that might influence the results. As the dependent variable, the time to complete the Schulte grid was chosen, as this was the primary performance measure. A first regression (Appendix B5) included task 1 boredom and inattention as well as personal factors and device type. The device type was included because the use of a touchscreen and a smaller display could inhibit the performance. The regression was significant overall, F(11, 34) = 2.695, $p < .05$, R^2 = .466, but included many insignificant factors. Additionally, due to the inclusion of results from stage 1, the control group was excluded from this regression. The regression showed task C boredom and the device type as the strongest predictors for performance. Another regression model resulted from removing insignificant factors and factors with little to no predictive value (Table 4). As the variables from stage 1 were not included anymore, the regression included the control group again. The model was significant at $p < .001$ and accounts for R^2 = .315 of the sample's variance. Again, task C boredom and the device type were the most significant predictors for cognitive performance.

Table 4: Significant regression on Schulte grid time

	R^2 (ΔR^2)	B	Std. Error	β	p
Model	.315				<.001***
(Constant)		172.711	52.602		.002**
Task C Boredom	(.065)	33.359	13.285	.300	.014*
Task C Inattention Score	(.059)	31.848	13.327	.283	.020*
Age	(.051)	2.211	.999	.230	.030*
Dummy: Mobile	(.065)	62.974	25.089	.260	.015*

* p < .05; ** p < .01; *** p < .001; N = 71

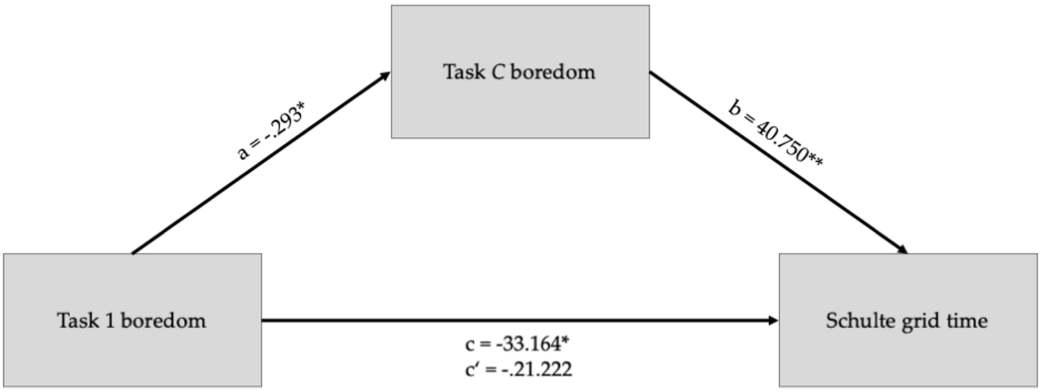

Figure 5: Mediation graph for task boredom and Schulte grid time

The results of the regression suggest that cognitive performance is influenced by age in addition to boredom and inattention. The device type is not interpreted as an influence on cognitive performance, but rather a potential obstruction that was controlled for. As age did not significantly differ between groups B-C (M = 33.43, SD = 13.56), I-C (M = 31.13, SD = 11.55) and Control (M = 31.64, SD = 11.26), age might predominantly explain variance inside the groups, as opposed to variance between the groups. The fact that the boredom score and inattention scores of task C influence the outcome separately in the controlled regression, each yielding a considerable ΔR^2, can be interpreted as further confirmation that boredom and concentration are related, but separate constructs. Importantly, their individual predictive value in the regression model might hint at different separate on performance, for example by leading to unwillingness (boredom) and inability (inattention) to perform.

In order to test whether any variables act as mediators for Schulte grid time, a mediation analysis according to Baron and Kenny (1986) was performed. As the factors task C boredom and inattention did not significantly predict Schulte grid time in a shared regression (Appendix B7), inattention could not be determined as a mediator. However, the mediation analysis yielded one very interesting insight: The effect going out from task 1 boredom on the Schulte table is fully mediated by task C boredom (Appendix B8, Figure 5).

5. Discussion

5.1. Interpretation and limitations of the results

This paper aimed to further the understanding of organizational boredom with a special focus on practical implications. To achieve this, a two-stage experiment was carried out, designed to capture multiple facets of boredom. Specifically, the experiment aimed to understand boredom beyond the scope of just one task and how these cross-task effects influence the outcomes of sequential tasks. In order to test the hypotheses and gain possible explanations for the results, regressions and a questionnaire were utilized. The experiment provided evidence that task boredom is subject to contextual effects and that these effects subsequently influence inattention and cognitive performance.

5.1.1. Contextual effects on boredom levels

In line with expectation and prior findings on psychological contrast effects (see chapter 2.3), the experiment showed significant results on the relativity of boredom in different contexts. Specifically, the findings corroborate the hypothesis that a highly boring first task will mitigate boredom in the subsequent task. These results hold up in comparison to an actively interesting task (I-C) as well as a control group. Correlation and regression analyses confirmed this cross-task relationship. As group I-C does not differ from the control group, this suggests that context effects only arise for a decrease in boredom.

One possible limitation regards the consistency of the effect. As outlined in chapter 2.3, minor differences between stimuli often result in convergence. In this context, that would mean that a task that is only slightly less boring would actually be perceived the same. As minor differences were not examined in this paper, more research is needed to address this possibility and its practical implications. However, the inherently subjective perception of boredom as well as the difficulty of controlling boredom on a miniscule level might limit research possibilities.

More limitations draw from the scales used to assess boredom. Firstly, these scales assessed multiple dimensions, including both low and high arousal. Intuitively, these subscales might impede one another. However, the scale was validated extensively (Fahlman et al., 2013, pp. 75–80) and care was taken to not add questions to the questionnaire that preclude each other. Secondly, the use of 5-point Likert scales could limit the results, as the responses from stage 1 could have acted as reference points for stage 2 and resulted in an anchoring bias and inflated differences. A 7- or 9-point Likert scale might have captured more nuanced results. However, given the validation of the MSBS, it was decided that that the validated 5-point measure should be used throughout the experiment.

Whether the effect is one-sided or not, the study concluded with significant results. Limitations are mainly limited to factors that prevent additional results, and not factors compromising the existing ones. Looking at the significance of results, it can thus be concluded that contrast effects do indeed pertain to state boredom, even though it remains an open question whether this effect is one-sided or not.

5.1.2. Concentration

In addition, it was shown that these contrast effects transcend to boredom's effect on concentration. Among both stages of the experiment, it was thus confirmed that boredom and concentration are highly correlated. This result is unsurprising, as the two constructs are often connected to each other and inattention is even one subscale of the MSBS. Similarly, the MAC model considers an attentional component while still allowing to separate the two constructs. So far, research on the causal relationship between boredom and inattention has tended to focus on sustained attention and vigilance tasks (e.g. Hunter & Eastwood, 2018), but not short-term, practical concentration.

The question whether boredom causes inattention or vice versa remains a controversial one, and existing research has suggested a relationship in both directions (Hunter & Eastwood, 2018, p. 2484). The lack of cross-task correlation between inattention scores in this paper suggests that boredom is the precursor. This does not need to be an either-or question though. It is entirely plausible that both boredom and inattention exhibit bidirectional causality. If this were the case, then boredom would lead to lower concentration, but at the same time low concentration would cause boredom. The relationship between boredom and media multitasking was shown to be bidirectional (Dora et al., 2021, pp. 3, 8), a phenomenon which could be apply to boredom and inattention too. Thus far, research has mainly concentrated on one-directional causal relationships and/or overlap of the two constructs, but a focus on bidirectional causality might lead to interesting insights.

Overall, the experiment concluded a direct, negative relationship between boredom and concentration during a task. Within the experiment, only the relationship between high boredom and low concentration could be confirmed, as group B-C, did not differ significantly from the control group. The natural interpretation of this effect is that the interesting task leads to a persistent distraction afterwards, but the one-sidedness might also come down to limitations of sample size and scales. Overall, the correlations and regressions showed a significant interaction of the two constructs boredom and inattention, with differences between the groups being influenced by the contrast effects outlined earlier in this paper.

5.1.3. Cognitive Performance

Finally, the influences of boredom on cognitive performance were explored. For this, multiple secondary measures (e.g. errors) were taken, showing a conclusive picture and thus confirmed the consistency of the measure. Regressions and comparisons showed a significant difference between groups, indicating that the boredom induction did indeed affect cognitive performance.

Regressions showed an inconclusive picture on the actual effect structure. While the correlation between task C inattention and task performance (measured as time to finish the Schulte grid) was the most significant (Appendix B4), multiple regressions with all factors classified it as fully insignificant and assigned it no explanatory value (Appendix B5). One possible explanation for the inconsistent regression results is the strong collinearity between the factors boredom and inattention in both tasks, which might have distorted the regression (Mason & Perreault, 1991, p. 269). A significant and highly predictive regression model with less factors (Table 4), however, found task C inattention as a significant predictor while controlling for external factors. Independently of the regression, the t-tests confirm the differences between groups.

The regression suggests that both boredom and inattention influence the performance during a task and exert effects of approximately the same strength. Due to the contrast effects, task 1 boredom had an influence on task C performance, which was fully mediated by task C boredom. Task C inattention did not take a mediator role, but still influenced the performance significantly. The two separate predictors boredom and inattention might be interpreted as unwillingness (boredom) and inability (inattention) to engage in the task at hand. Similar to the validated MAC model of boredom, this means that even one of the two factors inattention and boredom is enough to decrease cognitive performance. As additional factors, both age and the type of device (mobile or computer) were identified and included in the regression. Interestingly, the participants in the treatment groups were aware of their performance differences: Groups B-C (M =

2.96, SD = 1.33) and I-C (M = 4.00, SD = 1.06) differed significantly in their belief on whether they could have performed better in task 2, $t(47) = -3.054$, $p < .01$.

5.1.4. Further Insights and Limitations

Throughout the experiment, one interesting insight was the migration of effects from B-C to I-C. While for H1, B-C was significantly different from the other two groups, for H2 and H3, I-C was the one that differed. This effect draws from the position of the control group, while B-C and I-C remain steadily separated. Possible explanations are additional, not registered effects, which would also explain the disproportionately high inattention for group I-C. One possible explanation is simply the time lag between tasks. For group B-C and I-C, the two tasks followed one another right away, while the control group participants were eased into the experiment and had a high variation in what cognitive state they entered the experiment in. Accordingly, group I-C might have been more distracted through the recent video task than the control group. Overall, the validity of the control group can be viewed as a possible limitation. The questionnaire registered the last task completed before the experiment and did not find any imbalances between expected boring or interesting tasks, but the boredom before the beginning of the experiment was not controlled for. The same limitation could be extended to the whole experiment, as it was performed online and could not control for environmental or mood differences as thoroughly as a laboratory experiment.

An additional limitation is that performance could not be compared between task I and task C, as they differed in content. It is suggested that contrast effects are just as strong between leisure and work activities as they are between two work tasks (Dora et al., 2021, p. 11). As the role of the strength of contrast was not assessed, it remains unclear whether a boring first task itself could lead to additional negative consequences. This limitation could have been addressed through a different experimental design where the order between two tasks is changed and the combined performance is compared. The chosen design was opted for instead in order to guarantee a stronger boredom/interest induction and to explore the one-sidedness of the effect through a control group. However, as the control group started with task C, a complete workflow can be approximated as the sum of task C results from groups C + B-C and groups C + I-C. Assessing the performance this way, the results and implications hold up. Furthermore, as one task will always be the most boring, so the negative effects of boredom will emerge no matter when it is performed. Given this, starting with the most boring task will only yield benefits over the span of the subsequent tasks.

The fluctuation of the control group influences the interpretation of the actual effects. While H1 indicated a beneficial effect going out from boredom, the data for H2 and H3 suggests that boredom only neutralizes negative effects, as it does not significantly differ from the control group. It is thinkable that the effect goes in both directions, and the insignificance of effects only draws from the inadequate sample and scale size. It is noticeable that the three groups remain at a constant ranking – the control group is continuously placed in between B-C and I-C (Table 5). For example, the performance difference between B-C and the control group would have been significant at a group size of 250, assuming a one-sided t-test with same mean, standard deviation and a 95% confidence interval.

Next to leading to a more nuanced significance, a higher and more representative sample size could also have helped with regression analysis. For example, only three participants reported their employment status as unemployed, and all three were randomly assigned to group B-C. Accordingly, their effects did not have a base for comparison and limited the regression analysis when controlling for an effect. However, the effects with a sufficiently high sample size (e.g. students) were found to not influence the treatment effects, validating the effects attributed to the treatments.

Overall, even though sample size, chosen scales and the control group exert possible limitations, it can be concluded that the effects between treatment groups are conclusive and consistent. This study adds to our understanding of boredom by providing evidence on the existence of contrast effects and their follow-up effects on concentration and cognitive performance. Beyond the scope of the research question, the interaction between boredom and inattention is now thought to be a bidirectional one, concluding a possible starting point for future research.

5.2. Practical implications

Given the prevalence of boredom in the workplace and the wide consequences that can be caused by it, specifically among young people, this research can provide some practical guidance for work design and managerial practice.

Mainly, the results support the proposed prioritization method for tasks at work. While some tasks are unchangeably boring or interesting to a person, the task order could be a practical way to minimize boredom without side effects. This method suggests that workers begin a workflow with the most boring task and arrange the tasks in increasing order of interest. Because in contrast the tasks will be less boring, this is expected to decrease some negative outcomes associated with boredom. The effects on concentration and cognitive performance have already been proven in this paper, however, it can only be hypothesized that these effects apply to other effects, like counterproductive work behavior, as well. Of course, in practice this prioritization method is limited by other factors like deadlines, but even when considering this, additional benefits can be gained by utilizing the task order to neutralize boredom.

Additionally, the results imply certain concerns for work design. Workers and managers should be aware that smartphone breaks (when deemed more interesting than work) could subsequently increase boredom and decrease performance. Dora et al. (2021) concluded that “smartphone breaks were associated with subsequent increases in, and not with recovery from, boredom and fatigue”, which supports this implication as well. It goes without saying that

Table 5: Comparison of each experimental variable per group

	B-C		Control		I-C
Task C Mean Boredom	2.11	<	2.81	<	2.90
Task C Mean Inattention	1.62	<	1.86	<	2.37
Mean Time Task C	396.52	<	415.27	<	481.65

breaks are a necessary part of work, but it is helpful to be aware of the effects. For example, it might be advisable to either start with a boring task after a break, in order to decrease subsequent boredom. For both options, it is important that the tasks are ordered according to their boringness as much as practically possible. Beyond assessing contrast effects, person-environment fit should always be considered, in order to decrease potential boredom in the first place and enhance job satisfaction in the long run.

5.3. Implications and suggestions for further research

The insights brought up through this paper have a number of implications for boredom research, a field which is highly dynamic at this time. Especially the relationships between boredom and media use or computer-aided work are a recent topic of interest (e.g. Barkley & Lepp, 2021).

One of the longest-lasting and most controversial questions among boredom researchers is the relationship between boredom and attention. As outlined earlier in this paper, researchers are divided on which state is the predictor for the other. In the discussion, the idea of a bidirectional influence was presented, meaning that inattention will increase boredom and vice versa, with both conceivable as the independent variable. Prospective research could dive deeper into this relationship by isolating both boredom and attention systematically.

One way that this paper specifically could be enhanced is through the inclusion of qualitative overload. The experiment focused on qualitative underload, i.e. a task that induced boredom by being underchallenging and monotonous. Interesting insights could be gained by replicating the experiment with an overwhelmingly hard task, which would also induce a feeling of boredom. A possible task could be reading a highly complex science paper, which requires previous knowledge to fully understand. This task would be both challenging and passive, favoring the emergence of boredom.

Finally, replicative studies could aim to reveal a more nuanced picture of the topics discussed. On one hand, this could be done by removing the limitations discussed in chapter 5.1, for example through a higher sample size or a wider Likert scale. But to gain additional knowledge, the levels of boredom could be more nuanced. This way, possible assimilation effects or curvilinear relationships would be revealed. Additionally, the role of the actual strength of contrast could be quantified, for example when the comparison is not between boredom and interest but between high and low boredom/interest. In future iterations of the experiment, it would also be interesting to explore the endurance of the effect. The scope of this experiment rarely exceeded the 10-minute-mark, so no definite estimate could be given of how long-lived the effects actually are. Lastly, field studies would be an interesting addition to the laboratory-style research of this paper. This would bring new insights on the effects the proposed prioritization method in an actual work setting, including long-time performance and compatibility with other prioritization methods.

6. Conclusion

The goal of this paper was to determine potential effects that the task order can exert towards feelings of boredom and subsequently towards concentration and cognitive performance. When exploring the possible consequences of boredom, the role of task order and contrast effects were mostly ignored by researchers. Through an empirical study, this gap in recent research has been partially filled. However, more research is needed to obtain a complete picture and fully understand all relationships.

To answer the research question, an experiment was planned and carried out. The participants were divided into three groups, one of which started with an interesting task and one with a boring task. A control group started with the second stage of the experiment right away. Comparability was ensured by holding the task in the second stage of the experiment constant. Further control measures were taken through a questionnaire, registering both inattention and boredom of the participants during all tasks as well as additional control variables. Multiple measures were compared for each dimension of the research question. In addition, the groups were validated through systematic removal of participants that did not meet the boredom criteria, and multiple regression analyses were utilized to control for other factors that could affect the results.

The results of the experiment confirmed multiple of the hypotheses. Firstly, the existence of contrast effects regarding boredom could be confirmed. This means that more experienced boredom in one task will result in disproportionally less boredom in a following task, given that it was considered less boring in the first place. However, this effect could only be fully confirmed for one direction, namely a decrease in subsequent boredom. Looking at the relationship between high-interest tasks and subsequent boredom, the null hypothesis could not be rejected, even though a significant negative correlation exists for the whole sample. For practice, this carries implications on how workflows can be designed in order to minimize boredom and thus prevent at least some of the negative outcomes associated with it. The idea for this is to order tasks in order of increasing boringness, so the subsequent task will be considered less boring due to contrast effects.

The outcomes that the effects were explicitly assessed for were concentration and cognitive performance. Concentration was measured as inattention through the questionnaire. For both groups, a very high correlation was found between boredom and inattention. Due to the proximity between the control group and group B-C, the effect could again only be confirmed in one direction. The implication is that inattention arises specifically when a task was preceded by a very interesting, and thus possibly distracting, task. While no additional benefit could be proven for group B-C, the results show that boredom could still be a valuable tool to neutralize any negative consequences.

The findings on cognitive performance were analogue to those on concentration. The boredom group of the sample had a lower arithmetic mean in regard to time to completion, but the difference was not found to be significant. Again, the group that started with an interesting task performed worse than the other two. This is interpreted as a counterproductive effect exerted by the interest induction in stage 1, as the control group acts as the baseline. In addition to boredom, inattention showed an effect on task performance as well. Whether this effect was completely separate or only mediated by concentration could not be clearly determined, with the results from the regression and mediation analysis suggesting the former. Even though the full construct of relationships will have to be explored in future research, the high difference of more than a minute exceeded the expected difference and constitute a big impact in practice, depending on how persistent the effect is.

After concluding the results, possible explanations were discussed and limitations of the experiment were evaluated. While some limitations were found and should be addressed in subsequent research, the overall results were found to be significant and carry many implications for organizational practice and beyond. Boredom was found to negatively affect concentration and performance, and as it was found that the effects of boredom or interest can carry over to the subsequent task of a workflow. Given this, managers and workers should always consider the order of tasks as well as the specific fit with a given activity, not only to maximize performance but also to possibly increase overall job satisfaction and decrease the risk for counter-productive work behavior. Not every task can be easy or enjoyable for everyone, but with the right approach, it might at least become a bit easier and a bit more enjoyable.

References

Agnoli, S., Vanucci, M., Pelagatti, C., & Corazza, G. E. (2018). Exploring the link between mind wandering, mindfulness, and creativity: A multidimensional approach. *Creativity Research Journal*, *30*, 41-53.

Anwyl-Irvine, A., Dalmaijer, E. S., Hodges, N., & Evershed, J. K. (2021). Realistic precision and accuracy of online experiment platforms, web browsers, and devices. *Behavior Research Methods*, *53*, 1407-1425.

Anwyl-Irvine, A. L., Massonnié, J., Flitton, A., Kirkham, N., & Evershed, J. K. (2020). Gorilla in our midst: An online behavioral experiment builder. *Behavior Research Methods*, *52*, 388-407.

Barbalet, J. M. (1999). *Boredom and social meaning.*

Barkley, J. E., & Lepp, A. (2021). The effects of smartphone facilitated social media use, treadmill walking, and schoolwork on boredom in college students: Results of a within subjects, controlled experiment. *Computers in Human Behavior*, *114*.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.

Blitz, J. (2009). *The office (us), s05e14 "stress relief"*. NBC. Retrieved from https://www.youtube.com/watch?v=gO8N3L_aERg

Brickman, P., Coates, D., & Janoff-Bulman, R. (1978). *Lottery winners and accident victims: Is happiness relative?* (Vol. 36).

Bruursema, K., Kessler, S. R., & Spector, P. E. (2011). Bored employees misbehaving: The relationship between boredom and counterproductive work behaviour. *Work and Stress*, *25*, 93-107.

Cameron, J. (1991). *Terminator 2: Judgment day.* TriStar Pictures. Retrieved from https://www.youtube.com/watch?v=6z9qws7M8q8

Colvin, C. R., Diener, E., Pavot, W. G., & Allman, A. (1991). The psychic costs of intense positive affect. *Journal of Personality and Social Psychology*, *61*.

Cummings, M. L., Gao, F., & Thornburg, K. M. (2016). Boredom in the workplace: A new look at an old problem. *Human Factors*, *58*, 279-300.

Dora, J., Hooff, M. V., Geurts, S., Kompier, M., & Bijleveld, E. (2021). Fatigue, boredom and objectively measured smartphone use at work. *Royal Society Open Science*, *8*.

Drody, A. C., Ralph, B. C., Danckert, J., & Smilek, D. (2022). Boredom and media multitasking. *Frontiers in Psychology*, *13*.

Drory, A. (1982). Individual differences in boredom proneness and task effectiveness at work. *Personnel Psychology*, *35*, 141-151.

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*, 482-495.

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.

Farmer, R., & Sundberg, N. D. (1986). Boredom proneness: The development and correlates of a new scale. *Journal of Personality Assessment*, *50*, 4-17.

Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *Journal of Abnormal and Social Psychology*, *58*, 203-210.

Firstup.io. (2021). *Key statistics about milennials in the workforce.* Retrieved from https://firstup.io/blog/key-statistics-millennials-in-the-workplace/

Fisher, C. D. (1987). *Boredom: Construct, causes and consequences.*

Fisher, C. D. (1993). Boredom at work: A neglected concept. *Human Relations*, *46*, 395-417.

Gasper, K., & Middlewood, B. L. (2014). Approaching novel thoughts: Understanding why elation and boredom promote associative thought more than distress and relaxation. *Journal of Experimental Social Psychology*, *52*, 50-57.

Gkorezis, P., & Kastritsi, A. (2017). Employee expectations and intrinsic motivation: work-related boredom as a mediator. *Employee Relations*, *39*, 100-111.

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*, 647-666.

Greenlees, I., Thelwell, R., & Holder, T. (2006). Examining the efficacy of the concentration grid exercise as a concentration enhancement exercise. *Psychology of Sport and Exercise*, *7*, 29-39.

Greenson, R. R. (1953). On boredom. *Journal of the American Psychoanalytic Association*, *1*, 7-21.

Haager, J. S., Kuhbandner, C., & Pekrun, R. (2018). To be bored or not to be bored—how task-related boredom influences creative performance. *Journal of Creative Behavior*, *52*, 297-304.

Hackman, J. R., & Oldham, G. R. (1976). Motivation through the design of work: Test of a theory. *Organizational Behavior & Human Performance*, *16*, 250-279.

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.

Harju, L., Hakanen, J. J., & Schaufeli, W. B. (2014). Job boredom and its correlates in 87 finnish organizations. *Journal of Occupational and Environmental Medicine*, *56*, 911-918.

Herr, P. M., Sherman, S. J., & Fazio, R. H. (1983). On the consequences of priming: Assimilation and contrast effects. *Journal of Experimental Social Psychology*, *19*, 323-340.

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*, 2483-2492.

Ilgen, D. R., & Hollenbeck, J. (1991). The structure of work: Job design and roles. In (p. 165-207). Consulting Psychologists Press.

Johnsen, R. (2016). Boredom and organization studies. *Organization Studies*, *37*, 1403-1415.

Kahneman, D., Diener, E., & Schwarz, N. (1999). *Well-being: Foundations of hedonic psychology*. Russell Sage Foundation.

Kristof-Brown, A. L., Zimmerman, R. D., & B, E. C. J. H. (2005). Consequences of individuals' fit at work: A meta-analysis of person-job, person-organization, person-group, and person-supervisor fit. *Personnel Psychology*, *58*, 281-342.

Kulik, C. T., & Oldham, G. R. (1987). *Work design as an approach to person-environment fit* (Vol. 31).

Lipps, T. (1903). *Leitfaden der Psychologie*. Wilhelm Engelmann Verlag.

Loukidou, L., Loan-Clarke, J., & Daniels, K. (2009). Boredom in the workplace: More than monotonous tasks. *International Journal of Management Reviews*, *11*, 381-405.

Lufkin, B. (2021). *The damaging effects of 'boreout' at work.* Retrieved from https://www.bbc.com/worklife/article/20210701-the-damaging-effects-of-boreout-at-work

Luhrmann, B. (2022). *Elvis.* Warner Bros. Retrieved from https://www.youtube.com/watch?time_continue=2&v=KT3GNpxvI00&feature=emb_title

Mael, F., & Jex, S. (2015). Workplace boredom: An integrative model of traditional and contemporary approaches. *Group and Organization Management*, *40*, 131-159.

Mann, S., & Cadman, R. (2014). Does being bored make us more creative? *Creativity Research Journal*, *26*, 165-173.

Markey, A., Chin, A., Vanepps, E. M., & Loewenstein, G. (2014). Identifying a reliable boredom induction. *Perceptual and Motor Skills*, *119*, 237-253.

Martin, M., Sadlo, G., & Stew, G. (2006). The phenomenon of boredom. *Qualitative Research in Psychology*, *3*, 193-211.

Mason, C. H., & Perreault, W. D. (1991). Collinearity, power, and interpretation of multiple regression analysis. *Journal of Marketing Research*, *28*, 268-280.

Merrifield, C., & Danckert, J. (2014). Characterizing the psychophysiological signature of boredom. *Experimental Brain Research*, *232*, 481-491.

Metin, U. B., Taris, T. W., & Peeters, M. C. (2016). Measuring procrastination at work and its associated workplace aspects. *Personality and Individual Differences*, *101*, 254-263.

O'Hanlon, J. F. (1981). *Boredom: Practical consequences and a theory* (Vol. 49).

Preiss, D. D., Cosmelli, D., Grau, V., & Ortiz, D. (2016). Examining the influence of mind wandering and metacognition on creativity in university and vocational students. *Learning and Individual Differences*, *51*, 417-426.

Reijseger, G., Schaufeli, W. B., Peeters, M. C., Taris, T. W., van Beek, I., & Ouweneel, E. (2013). Watching the paint dry at work: psychometric examination of the dutch boredom scale. *Anxiety, Stress and Coping*,

26, 508-525.
Riskey, D. R., Parducci, A., & Beauchamp, G. K. (1979). *Effects of context in judgments of sweetness and pleasantness* (Vol. 26).
Russell, B. (1932). *The conquest of happiness* (5th ed.). George Allen & Unwin Ltd.
Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being self-determination theory. *American Psychologist*, *55*, 68-78.
Sahlqvist, S., Song, Y., Bull, F., Adams, E., Preston, J., & Ogilvie, D. (2011). Effect of questionnaire length, personalisation and reminder type on response rate to a complex postal survey: randomised controlled trial. *BMC Medical Research Methodology*, *11*, 62.
Sherif, M., Taub, D., & Hovland, C. I. (1961). *Social judgment: Assimilation and contrast effects in communication and attitude change.* Yale University Press.
Shin, J., & Grant, A. M. (2019). Bored by interest: Intrinsic motivation in one task can reduce performance on other tasks. *AMJ*, *62*, 415-436.
Smallwood, J., & Schooler, J. W. (2006). The restless mind. *Psychological Bulletin*, *132*, 946-958.
Smith, C. A., & Ellsworth, P. C. (1985). Patterns of cognitive appraisal in emotion. *Journal of Personality and Social Psychology*, *48*, 813-838.
Smith, P. C. (1955). *The prediction of individual differences in susceptibility to industrial monotony 1* (Vol. 39).
Spector, P. E., Fox, S., Penney, L. M., Bruursema, K., Goh, A., & Kessler, S. (2006). The dimensionality of counterproductivity: Are all counterproductive behaviors created equal? *Journal of Vocational Behavior*, *68*, 446-460.
TikTok. (n.d.). *Tiktok compilation.* ByteDance. Retrieved from https://www.youtube.com/watch?v=VPa_pF5UFi0&feature=emb_imp_woyt
Udemy. (2016). *2016 udemy workplace boredom study.*
van Hooff, M. L., & van Hooft, E. A. (2014). Boredom at work: Proximal and distal consequences of affective work-related boredom. *Journal of Occupational Health Psychology*, *19*, 348-359.
van Hooft, E. A., & van Hooff, M. L. (2018). The state of boredom: Frustrating or depressing? *Motivation and Emotion*, *42*, 931-946.
van Tilburg, W. A., & Igou, E. R. (2017). Boredom begs to differ: Differentiation from other negative emotions. *Emotion*, *17*, 309-322.
Watson, D., Clark, L. A., & Carey, G. (1988). Positive and negative affectivity and their relation to anxiety and depressive disorders. *Journal of Abnormal Psychology*, *97*, 346-333.
Weissinger, E., Caldwell, L. L., & Bandalos, D. L. (1992). Relation between intrinsic motivation and boredom in leisure time. *Leisure Sciences*, *14*, 317-325.
Westgate, E. C., & Steidle, B. (2020). Lost by definition: Why boredom matters for psychology and society. *Social and Personality Psychology Compass*, *14*.
Westgate, E. C., & Wilson, T. D. (2018). Boring thoughts and bored minds: The mac model of boredom and cognitive engagement. *Psychological Review*, *125*, 689-713.
Wexley, K. N., Yukl, G. A., Kovacs, S. Z., & Sanders, R. E. (1972). *Importance of contrast effects in employment interviews* (Vol. 56).
White, J. (2014). *Millennial generation eager to work, 'but on their terms'.*
Wilson, T. D., Reinhard, D. A., Westgate, E. C., Gilbert, D. T., Ellerbeck, N., Hahn, C., . . . Shaked, A. (2014). Just think: The challenges of the disengaged mind. *Science*, *345*, 75-77.
Winograd, M., & Hais, M. (2014). *How millennials could upend Wall Street and corporate America.* Retrieved from http://finance.yahoo.com/news/live-facebooks-investor-call-whatsapp-225719757.
Wojtowicz, Z., Chater, N., & Loewenstein, G. (2021). *Boredom and flow: An opportunity cost theory of attention-directing motivational states.* Retrieved from https://ssrn.com/abstract=3339123
Wu, H., & Leung, S.-O. (2017). Can likert scales be treated as interval scales?—a simulation study. *Journal of Social Service Research*, *43*, 527-532.