Tangential Immersion:

Increasing Persistence in Boring Consumer Behaviors

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ABSTRACT

Consumers' lives are filled with myriad behaviors that can be successfully executed with minimal attention. Many such low-attention behaviors benefit from persistence but are often not performed long enough (e.g., hygiene, exercise). The current work examines consumer persistence-failures through an attentional lens. Specifically, drawing on boredom and resource-matching frameworks, we suggest one key driver of poor consumer persistence is that many behaviors demand *less* attention than consumers have available, leaving excess attention that leads to boredom and premature abandonment. The current research thus proposes an attention-matching framework for persistence and suggests that concurrently performing a task that engages *excess* attention will improve the match between attentional demands and available resources, thereby increasing persistence. Five experiments across a range of low-attention behaviors (e.g., toothbrushing, coordination exercise) demonstrate that concurrently performing a task that occupies excess attention (e.g., reading, listening), delays boredom and increases persistence. Moreover, two important boundary conditions arise. First, the focal behavior must require minimal attention, leaving excess attention available to attend to the tangential task. Second, the tangential task must engage excess attention without exceeding attentional capacity. This research provides important theoretical and practical contributions, offering the potential to improve consumer well-being by increasing persistence in low-attention behaviors.

Keywords: boredom, attention, multitasking, persistence, well-being

Consumers' daily lives are filled with behaviors that, once initiated, can be successfully executed with minimal attention. Over the course of a few hours, a consumer may brush her teeth, wash her hands (multiple times), and go for a walk—all behaviors that contribute to her health and well-being (CDC 2019a; CDC 2019b; Mayo Clinic 2019). Many of these behaviors benefit from prolonged performance—yet, consumers often fail to persist in them as long as they should. The average person brushes their teeth for less than half the recommended duration (ADA 2019; Gallagher et al. 2014), 95% of people do not wash their hands long enough to be effective (Borchgrevink, Cha, and Kim 2013), and nearly 80% of adults do not get enough exercise (Piercy et al. 2018). Poor persistence not only affects consumers directly, but also extends to their use of products and services. Many companies suffer as a result of consumers failing to use their products or services for long enough: consumers do not brush their teeth as long as they should (and thus purchase new brushes less frequently); they underuse their fitness equipment and gym memberships; and many stop cleaning their houses prematurely (leaving not only germs behind, but also using less cleaning product; see table 1 for additional examples). Such insufficient persistence may also lead to low product efficacy (compared to the advertised benefits), resulting in reduced consumer satisfaction and potentially higher product abandonment. Given the importance of such behaviors, products, and services, many researchers (as well as companies, service providers, and consumers) have invested a great deal in trying to increase persistence in (and with) them. However, consumers are still not persisting in many behaviors sufficiently;[1] as such, a large gap in understanding the barriers to persistence, and how to overcome them, remains. The current research identifies one reason why consumers stop

[1] While persistence often has an upper limit (e.g., one can walk too much, brush too long), most consumers stop at a point when prolonging the behavior remains beneficial.

behaviors prematurely and proposes an attention-matching framework to increase persistence.[2]

Insert table 1 about here

The behaviors we examine involve two necessary components. First and foremost, once initiated, they demand minimal attention to perform—either because of task simplicity (e.g., stuffing envelopes, a repetitive typing task) or because of frequent performance (e.g., everyday behaviors like walking, toothbrushing, handwashing). Second, consumers must have some intrinsic (e.g., walking is good for me) or extrinsic (e.g., my insurance will give me a discount for walking) *reason* to persist in them (otherwise, they simply would not engage). Notably, for some such behaviors (but not all), consumers seem to naturally add secondary tasks alongside them. Entering most any gym, for instance, will likely reveal rows of consumers walking on treadmills (a behavior that itself demands little attention) while watching television or listening to something on their headphones. While we would argue that such secondary tasks lead to increased persistence at the gym, there are many contexts where consumers fail to add a secondary task and consequently fail to persist. The current work examines the common consumer phenomenon of persistence-failures through an attentional lens and draws on theoretical frameworks in boredom and resource-matching to provide insight on poor persistence in consumer behaviors, offering a novel framework to explain *when, why,* and *how* adding a

[2] In this research, we define persistence as a continuous measure and examine how long consumers persist in a single period after initiation.

secondary task does (and does not) most effectively increase persistence.

The human mind desires engagement, and when a given activity or experience fails to engage one's attention, boredom arises (Eastwood et al. 2012). Boredom can occur both when a consumer does not want to engage in a task (i.e., it is seen as meaningless), *or* when a task demands inadequate amounts of attention—the latter of which can occur either because a task is too simple (e.g., solving math problems below one's ability) or because it is too difficult (e.g., solving highly complex math problems beyond one's ability; Westgate and Wilson 2018). In this work we focus on boredom that arises during tasks that demand low levels of attention (i.e., tasks that can be successfully performed without engaging much of one's available attention).[3] Boredom is an unpleasant emotion which people will attempt to alleviate, often by seeking out additional stimulation (Wilson et al. 2014), or simply changing activities (Csikszentmihalyi 1990). Because frequently performed (or simple) consumer behaviors require minimal attention (Ouellete and Wood 1998), we suggest they can leave the mind with excess (unused) attentional resources that lead to boredom and premature abandonment.

While changing a simple task to make it more challenging can increase attentional demands and decrease boredom (Westgate and Wilson 2018), doing so is not always possible or sustainable. We thus introduce a model in which total attentional demands can be increased by engaging *excess* attention (available attentional resources above and beyond those demanded by the low-attention task) in a *separate, concurrent* task. We refer to this as *tangential immersion*—we define a task as *tangential* if it is separate from a focal task but occurs in parallel to it, and

[3] Note this differs from behaviors *that demand higher levels of attention* but are boring either because they are too difficult or because they are not interesting and consumers do not want to engage in them—these tasks require attention to be successfully performed and thus will suffer from a lack of sufficient attention directed to them (e.g., zoning out during a class lecture and failing to process the content).

immersive[4] if it engages and sustains attention. We propose that having one's excess (unused) attention engaged in a tangential task while performing a low-attention behavior will improve the match between total attentional demands and a consumer's available resources. Thus, a focal task that requires more (or less) attention, can be paired with a tangential task that requires less (or more) attention. By reducing excess attention during a low-attention behavior, boredom will be delayed, and most critically, persistence will increase. Because maintaining attention is difficult, people's attention will start to wane over time—thus, even when tangentially immersed, attentional engagement will eventually diminish, and boredom will set in. Importantly, we predict it will take longer to reach this stage when tangentially immersed (vs. not). Of course, given consumers have limited attentional capacity, adding a tangential task will only increase persistence if it does not exceed available resources (see figure 1).

Insert figure 1 about here

This research makes several important theoretical contributions. First, by considering persistence through an attentional lens and drawing on boredom and resource-matching frameworks, it offers new insights as to why consumers fail to sufficiently persist in many behaviors and provides a comprehensive understanding of how adding attentional demands can increase persistence. Second, it introduces a conceptual model of sum attentional demands and

[4] We build on previous definitions of immersion which center around the role of attention and the concept of "losing oneself" in an immersive stimulus (e.g., Csikszentmihalyi 1990; Jennett et al. 2008; Van Laer et al. 2014).

empirically demonstrates that engaging attentional resources across multiple tasks can delay boredom. Third, it demonstrates that improving the match between total attentional demands and available resources not only reduces boredom, but can also increase persistence in low-attention behaviors. By focusing specifically on behaviors for which persistence is beneficial, this research also provides substantial practical implications for both companies and consumers. In particular, we shed light on when, why, and how coupling tasks can increase persistence, offering insights to product designers, marketing managers, and policymakers on ways to structure experiences, as well as design products (and product bundles), to increase persistence in otherwise boring behaviors.

CONCEPTUAL DEVELOPMENT

Existing Approaches to Increase Consumer Persistence

Efforts to increase persistence in the consumer behavior and psychology literature often involve setting and monitoring goals (Bravata 2007; Locke and Latham 1990), or increasing motivation (Woolley and Fishbach 2016). For example, a systematic review of interventions aiming to increase walking found that having a step goal and using a pedometer to track steps increased average number of steps per day (Bravata 2007). Persistence has also been successfully boosted by introducing extrinsic motivators (e.g., financial incentives; DellaVigna and Pope 2018), as well as intrinsic ones (e.g., focusing on the experience versus instrumentality of an activity, or making the task more fun; Fishbach and Choi 2012; Woolley and Fishbach 2016).

Some existing research has specifically examined the effect of adding tasks to an otherwise tedious task. For instance, consumers go to the gym more frequently when they bundle working out (a "should behavior") with listening to an indulgent audiobook (a "want behavior"; Kirgios et al. 2020; Milkman, Minson, and Volpp 2014). This previous work demonstrates that bundling a tedious behavior with an indulgent one can serve as a commitment device that increases initiation of the tedious task. Notably, this previous research specifically examines repeated initiation and does not assess within period persistence, as we do here. In another set of experiments, Woolley and Fishbach (2016) demonstrate that choosing more enjoyable activities or making an activity more fun by introducing immediate rewards increases persistence. For instance, in one study, they found students performed more math problems when the task was made more enjoyable by using colored pens, listening to calming music, and eating healthy snacks. Thus, making a task—in this instance a tedious task that people may not be endogenously motivated to attend to—more enjoyable can increase persistence in it.

Both increasing enjoyment and interest in a task can increase persistence—for instance, if people believe there is a reason to persist in a task, they are able to anticipate that changing something about the context of the task (e.g., playing music) may make it more fun or interesting and thus help them persist (Sansone et al. 1992). However, while a task can be both enjoyable and interesting—and indeed, a more enjoyable task is often inherently more interesting—they are, in fact, distinct constructs (Reeve 1989; Silvia 2005). Interest is often associated with curiosity, exploration, and attention (Izard 1977) and need not always be pleasant. In this way, a task can be enjoyable but not necessarily interesting (e.g., pleasant music) or interesting but not necessarily enjoyable (e.g., disturbing pictures; Turner and Silvia 2006). The current research focuses on behaviors with insufficient attentional demands. Thus, we propose that, in such instances, adding a concurrent task that occupies excess attention will more effectively stave off boredom and increase persistence compared to adding a task that is enjoyable but does not increase attentional demands.

Attention and Boredom

Attention is the act of selecting and modulating information. Attention can be *directed* to external cues (e.g., a noise in the room), or to internal cues (e.g., thoughts or sensations) and can be *endogenously driven* (e.g., top-down, goal-directed), or *exogenously driven* (i.e., bottom-up, stimulus-driven; Chun et al. 2011). Endogenous attention is purposeful and voluntarily directed, such as paying attention to a TV program of interest and tuning out other activity in the room, or carefully comparing different brands of toothbrushes in the supermarket. In this way, attention can be endogenously driven out of interest, or necessity (or even simply following instructions). Exogenous attention, on the other hand, is often captured by external events or things in the environment, such as having one's attention captured by the sound of a door slamming, or a light flickering in the room across the hall.

In a seminal paper in the boredom literature, Eastwood et al. (2012) propose that failure to engage attention is a key cause of boredom. Westgate and Wilson's (2018) Meaning and Attentional Components (MAC) model extends this work and introduces attentional failures *and* lack of meaning as orthogonal drivers of boredom. The authors define boredom as that which occurs when one is unable to engage their attention in a meaningful (i.e., *goal-congruent*) activity. Holding meaning constant, the authors demonstrate that a misalignment in cognitive demands and resources can occur both when demands are too low *or* too high. Earlier work by Fisher (1993, 1998) similarly suggests that boredom is U-shaped with respect to mastery and can occur both when a task is too simple (e.g., doing a repetitive task with low cognitive demands) as well as a when a task is too demanding (e.g., listening to a complicated lecture beyond one's understanding).

Boredom is an aversive emotion which people attempt to alleviate (Bench and Lench 2019; Wilson et al. 2014) and often drives a desire to switch activities (van Tilburg and Igou 2012). If unable to change tasks, however, people may seek out additional forms of external stimulation, such as doodling (Andrade 2010), or even go so far as to self-administer electric shocks, as some people would rather feel physical pain than feel bored (Wilson et al. 2014). When bored, people may also seek to occupy unused attention by mind wandering (Smallwood and Schooler 2006; Smallwood and Schooler 2015); for instance, while doing the dishes, a consumer's mind may try to occupy excess attention by daydreaming about an upcoming trip to Hawaii. For this reason, mind wandering is often used as a measure of boredom and attentional fit with a task (i.e., when a task does not require full attention, the mind starts to wander). Notably, because mind wandering can decrease attention to a task, it (as well as other distractors) can also be interpreted as a signal that a task is boring—for example, if that consumer begins to think about her upcoming trip to Hawaii later on while watching TV, she might infer (correctly or incorrectly) that the program was not interesting enough to hold her attention. As such, experimentally inducing mind wandering (and other distractions) has also been shown to affect perceptions of a task (Critcher and Gilovich 2010; Wang, Hong, and Zhou 2017; see web appendix for additional discussion). In this way, mind wandering can both result from as well as self-signal boredom.

As mentioned, lack of attentional engagement may occur because a task demands less attention than one has available or because of a lack of interest in the task (or topic). In both instances, an individual may start to mind wander to increase stimulation. Whereas mind wandering during a low-attention task is unlikely to affect performance, as the focal task requires little attention to perform (e.g., mind wandering while walking on a treadmill is unlikely to affect walking), mind wandering during a boring but attention-demanding task might lower performance (e.g., mind wandering during a class lecture inhibits one from processing the content of the lecture). For this reason, some research has investigated ways to decrease mind wandering during tasks that require focused attention, but are uninteresting—for example, Chinchanachokchai, Duff, and Faber (2019) demonstrate that decreasing mind wandering can increase memory for mundane advertisements (i.e., ads that require focused attention to process, but fail to interest listeners). The authors show that performing a low-load perceptual task (i.e., a visual search task) while listening to a monotone advertisement can increase recall for the ad by decreasing mind wandering (which distracts from processing the ad content).

This previous work builds on models such as load theory, which assume that (1) attention is limited, and (2) all attentional capacity will be used, and the amount of attention paid to distractors will depend on the load required by the primary task (Lavie 2005)—thus, when a primary task is challenging, people will be less likely to process distractors, whereas when it is simple, excess attention will spill over and process distractor stimuli. Both the current and previous work aim to address failures of attention; however, whereas the previous research examines ways to decrease internal attentional distractions (i.e., mind wandering) during an *uninteresting, but high-attention task*, thereby redirecting attention to it, the current work investigates how to externally occupy *unused* attention during a *low-attention* task in order to increase persistence in it.

In addition to identifying cases where internal distractions (i.e., mind wandering) can be harmful by reducing the processing of an attention-demanding task, prior work also demonstrates that distractions can be beneficial when they pull attention away from attention-demanding experiences that are unpleasant, such as physical pain (for reviews see Eccleston and Crombez 1999; McCaul and Malott 1984). As defined in the literature, distractions involve stimuli that *detract* attention from another task. Tangential immersion can be characterized as a special type of distractor task—specifically demonstrating that when a focal task requires low levels of attention, a concurrent distractor task can *capture excess attention without detracting attention* from the focal task (see appendix for summary of selected relevant research).

Tangential Immersion: An Attention-Matching Theory of Persistence

In addition to the boredom literature, several other theories focus on the concept of matching cognitive resources to the demands of a task or message. For instance, a key tenet of flow theory is a proper match between challenge and skill (Csikszentmihalyi 1990). Relatedly, in the consumer persuasion literature, resource-matching theory suggests that persuasion will be increased when a consumer's processing resources match—rather than fall below or exceed—the resources necessary to process a message (Anand and Sternthal 1998; Keller and Block 1997; Peracchio and Meyers-Levy 1997). For example, Meyers-Levy and Peracchio (1995) find that whether an ad with color (vs. black and white or color-highlighting) is more (or less) persuasive depends on the processing requirements of the ad. In the current research, we also propose a resource-matching framework. We suggest that a mismatch between attentional demands and available attentional resources leads consumers to stop many behaviors prematurely. We thus propose that while performing a low-attention task, occupying excess attention in a second task will help balance this mismatch, thereby delaying boredom and increasing persistence.

Tangential immersion is a form of dual tasking (doing two tasks at once). Dual tasking is often discouraged as attending to two tasks can decrease attention to at least one of them, which can result in a performance decrement (Kahneman 1973; Pashler 1984, 1994). However, operations that are performed consistently tend to become automatic (Ouellette and Wood 1998), allowing individuals to successfully perform them in parallel with other tasks without suffering from interference (Lien, Ruthruff, and Johnston 2006).[5] Indeed, simply practicing tasks has been shown to reduce dual-task interference (Hazeltine, Teague, and Ivry 2002; Schumacher et al. 2001). Thus, for low-attention tasks, we posit that dual tasking will add attentional demands without causing much, if any, performance interference, as tangential immersion will occupy excess attention and not pull attention away from the focal task.

Following from our attention-matching predictions, two natural boundaries arise. We propose that tangential immersion will increase persistence in a low-attention behavior, but only in so far as both tasks, together, do not surpass attentional capacity. Thus, if the *focal behavior requires too much attention*, such that consumers are unable to attend to the tangential task, adding a tangential task will not increase persistence. For instance, if a student is intensely focused on writing a paper, she may tune out a television show playing in the background (as her attention is completely engaged in her work), and it thus should not affect her persistence. Second, while the behaviors we investigate are low-attention, they still require some attention—as such, the *tangential task must not require so much attention* that it surpasses a consumer's

[5] Whether dual-task interference can be eliminated has been debated in the literature (Lien et al. 2006), and certain tasks—even those that are well practiced—may never become fully automatized and thus may always suffer from some interference (e.g., driving; Levy, Pashler, Boer 2006).

attentional capacity and limits their ability to continue the focal behavior. For instance, if watching an action-packed thriller while walking on a treadmill, a consumer may find himself stopping, without even realizing it, in order to devote his full attention to the movie.

THE CURRENT RESEARCH

The analysis above yields several tenets on which we build. First, both simple behaviors and oft-repeated behaviors, once initiated, require minimal attention to perform. When people engage in tasks that require fewer attentional resources than they have available, they experience boredom. Boredom is an aversive state that may drive consumers to seek additional stimulation or stop a task entirely (when they have the flexibility to do so). Second, immersive stimuli can engage and sustain consumer attention. Third, people can do two things at once with little performance interference when at least one of those tasks requires minimal attention. Putting these together, we suggest that performing an immersive task concurrently with a low–attention behavior will occupy excess attention, thereby improving the match between attentional demands and available resources, delaying boredom and increasing persistence in the focal behavior.

Across a series of experiments, we demonstrate that participants performing a low-attention behavior while immersed in a tangential task persist longer in the focal behavior. We provide support for tangential immersion as a key driver of persistence by demonstrating that an immersive tangential task increases persistence more than a task that is more pleasant or enjoyable, but less immersive (experiments 1 and 2). We also show that tangential immersion increases persistence beyond tracking one's behavior (experiment 1s; web appendix), and with different forms of immersive tasks, including watching a video (experiment 1), listening to an audio clip (experiment 4), and reading a story (experiments 2 and 5). Moreover, we show that tangential immersion increases persistence across a range of behaviors, including toothbrushing (experiment 1), a typing task (experiments 1s and 4), and a coordination exercise (experiments 2 and 5). Importantly, we demonstrate that tangential immersion attenuates boredom by reducing excess attention (experiment 3). Finally, we provide evidence for the two predicted boundary conditions (experiments 4 and 5). Unless otherwise noted, all primary measures are reported in the manuscript, secondary measures are reported in the web appendix, and no additional participants are excluded. Preregistrations, materials, and data are available on OSF (https://osf.io/vy6cz/?view_only=f3dc6b16a38c4c5fb0fdfbf1d248f504).

EXPERIMENT 1: TANGENTIAL IMMERSION INCREASES TOOTHBRUSHING PERSISTENCE

Experiment 1 tests whether tangential immersion increases persistence in an important health behavior: toothbrushing. Toothbrushing is a routine behavior that can be performed in an automatic fashion (Aunger 2007). We test whether watching a more immersive (vs. less immersive, but more pleasant) video while toothbrushing increases brushing persistence. We predict that participants who watch the more immersive (vs. less immersive) video will brush longer. This experiment tests our primary hypothesis, as well as provides important insight for consumers and marketers on the choice of a tangential task—when increasing persistence is the goal, it is essential to choose a tangential task that sustains excess attention (not one that is simply more pleasant).

Method

This study ran in the behavioral laboratory of a large West Coast University for one week. Four hundred twenty undergraduates participated in exchange for course credit and passed our preregistered inclusion criteria (60% female, M_{age} = 21.03, SD_{age} = 2.36). Participants began the study by reading that it was the start of a new year (it was January) and the perfect time to build new, healthy habits. Participants learned about a method called dry brushing. Dry brushing involves brushing one's teeth without water or toothpaste, it can be done anywhere, and is a good method for removing plaque. Although the concept of dry brushing may be new to some participants, the behavior itself is equivalent to routine toothbrushing. Participants read that they would be able to try dry brushing and that we would give them a video to watch while brushing. They were informed that dentists recommend dry brushing for at least 8 to 10 minutes and that the longer they brush the cleaner their teeth would be—but that for today's study, they could dry brush for as long as they wanted.

Participants received an individually packaged toothbrush and dry brushed while watching one of two videos: a segment from Animal Planet (more-immersive condition) or a video with nature scenes and classical music (less-immersive condition). We chose to use a narrative for our more immersive task, as narratives are commonly used for their ability to engage attention (Van Laer et al. 2014). Both video clips were around 10 minutes. We selected excerpts from longer videos to demonstrate that consumers persist longer because the tangential task occupies their excess attention, and not out of a need for closure (Kruglanski and Webster 1996). A pretest (N = 95) revealed the two videos were liked no differently ($M_{more\text{-}immersive}$ = 5.61 vs. $M_{less\text{-}immersive}$ = 5.30; b = .31, t(93) = 1.02, p = .311); the more immersive video was rated as significantly less pleasant and beautiful than the less immersive nature video (2-item scale; r = .48, $p < .001$; $M_{more\text{-}immersive} = 5.26$ vs. $M_{less\text{-}immersive} = 6.01$; $b = -.76$, $t(93) = -3.40$, $p < .001$); but, Animal Planet was significantly more immersive (5-item scale; $\alpha = .85$; $M_{more\text{-}immersive} = 4.94$ vs. $M_{less\text{-}immersive} = 4.36$; $b = .58$, $t(93) = 2.05$, $p = .043$; see web appendix for pretest details).

Participants began the video and proceeded to dry brush. When they did not want to dry brush any longer, they disposed of their toothbrush and moved to the next page where they responded to several questions about their perceptions of dry brushing. Specifically, they were asked: “How much did you enjoy dry brushing?”; “To what extent did you find dry brushing boring?”; “While dry brushing, how much was your mind wandering (i.e., how much were you thinking about things unrelated to dry brushing or the video?)”; and “How likely are you to dry brush again in the future?” (1 = Not at all to 7 = Very [or A lot]). Finally, participants were asked a comprehension check, if they had ever tried dry brushing before, how often they usually brush their teeth, their gender, age, and how well they speak English (see web appendix for details).

Results

Persistence. In all experiments, we present persistence in real-time seconds and conduct analyses with both untransformed and log-transformed durations. As predicted, participants who watched the more immersive video brushed their teeth significantly longer (M = 172 seconds) than participants who watched the less immersive video (M = 132 seconds; $b = 39.65$, $t(418) = 3.70$, $p < .001$; logged: $b = .17$, $t(418) = 2.18$, $p = .030$). Persistence remains significant when controlling for whether they had ever heard of dry brushing prior to the study and how often they brush their teeth ($p < .001$; logged: $p = .031$).

Self-Reported Perceptions. Across conditions, participants reported no differences in how enjoyable ($M_{more\text{-}immersive}$ = 3.07 vs. $M_{less\text{-}immersive}$ = 3.16; b = -.08, t(418) = -.50, p = .615) or boring ($M_{more\text{-}immersive}$ = 4.50 vs. $M_{less\text{-}immersive}$ = 4.67; b = -.18, t(418) = -1.00, p = .318) they found dry brushing. Further, they reported no differences in how much they mind wandered while brushing ($M_{more\text{-}immersive}$ = 4.36 vs. $M_{less\text{-}immersive}$ = 4.60; b = -.25, t(418) = -1.26, p = .207), or their intentions to dry brush again in the future ($M_{more\text{-}immersive}$ = 2.92 vs. $M_{less\text{-}immersive}$ = 3.07; b = -.15, t(418) = -.84, p = .402).

Discussion

Experiment 1 demonstrates that tangential immersion increases toothbrushing persistence. We found participants who watched a more (vs. less) immersive video brushed their teeth, on average, 30% longer. Notably, the more immersive video was rated as *less* pleasant than the less immersive video, highlighting that tangential tasks that are more immersive, even when they are not more pleasant, will lead to greater persistence. Moreover, while the more immersive video sustained attention longer, the less immersive video was still somewhat immersive (relative to watching nothing). This is therefore not only a conservative test of tangential immersion but suggests the magnitude may be even larger compared to the typical scenario of people toothbrushing without any tangential activity.

The self-reported perceptions measures show that participants' boredom (and enjoyment) was no different across conditions *when they chose to stop brushing*, but that they reached this point later when tangentially immersed. This finding provides evidence that tangential immersion delays boredom. Finally, the immersive video was an excerpt from a full-length show, reducing concerns that need for closure drove persistence (Kruglanski and Webster 1996). Given the importance of oral health, these results suggest that a simple (and very low-cost) intervention could have a significant impact on individual health and well-being.

EXPERIMENT 2: TANGENTIAL IMMERSION INCREASES PERSISTENCE MORE THAN ENJOYABLE (BUT LESS-IMMERSIVE) TASKS

Experiment 2 tests whether tangential immersion increases persistence in a coordination exercise. In this study, participants perform a low-attention exercise for as long as they can. In addition to being given a persistence goal, this study is also incentive compatible such that participants who persist longer have a better chance of earning a reward.

Experiment 2 also examines whether a more pleasant but less immersive tangential task influences ratings of the overall experience, and whether this affects persistence. Although tangential immersion certainly may be achieved by an enjoyable task, experiment 2 aims to demonstrate that enjoyment alone does not prolong performance.[6] We predict that, while performing a low-attention coordination exercise, participants who listen to pleasant music will report the experience as overall more enjoyable (vs. control), but only participants who read an immersive story will persist longer.

Method

[6] In an additional study (experiment 1s in the web appendix), we demonstrate tangential immersion also increases persistence relative to monitoring one’s progress, as well as compared to a pure control condition.

This study ran in the behavioral laboratory of a large West Coast University for four weeks (one of which only had three available laboratory days). Four hundred eleven undergraduates participated in exchange for course credit (56% female). Participants were brought into a room one at a time. They read that the study was about multitasking and they would be performing two tasks concurrently. Participants were shown instructions for the focal activity: a low-attention exercise in which they were to hold their arm parallel to the floor while holding their cell phone (which acted as a weight) for as long as they could. While doing the exercise, participants were randomly assigned to one of three tangential tasks: watch a dot scrolling across the computer screen (control); read a story scrolling across the screen (reading); or, view a pleasant image accompanied by piano music (pleasant).

A pretest (N = 368) examined whether the tangential tasks successfully manipulated immersion and enjoyability. Participants were randomly assigned to one of the tangential tasks and then rated its enjoyability (2-item scale; r = .89; p < .001), immersiveness (3-item scale; α = .83), and perceived importance. In support of the manipulation, the pleasant task (M = 4.69) was rated as significantly more enjoyable than both the control (M = 1.88) and reading tasks (M = 3.00; bs = 2.81 and 1.69, ts(365) = 14.06 and 8.76, ps < .001). On the other hand, the reading task (M = 3.88) was significantly more immersive than both the control (M = 1.95) and pleasant tasks (M = 3.19; bs = 1.93 and .68, ts(365) = 10.22 and 3.72, ps < .001). The reading (M = 2.50) and pleasant tasks (M = 2.62) were both perceived as more important than the control task (M = 1.85; bs = .65 and .77, ts(365) = 3.33 and 3.92, ps <.001), but were not significantly different from each other (b = .12, t(365) = .66, p = .511; see web appendix for pretest details).

In all three conditions, participants had to press play to start the tangential task and all three media files were the same length (3 minutes and 48 seconds). Participants in the reading condition were told that at the end of the study, they would be asked to answer a few questions about the content of what they read. These questions were designed to encourage attention to the tangential task and are thus not discussed further.[7]

Participants held out their arm and pressed play. A research assistant in the room used a stopwatch to time how long each individual persisted in holding out their arm (the primary dependent variable in this experiment). We enhanced the advantages of persistence by informing participants that those who persisted longer than the average would be entered into a lottery to win $25. After putting their arm down, participants responded to manipulation checks (experiential enjoyment, focus, and immersion) as well as items measuring pain, to what extent they forgot they were holding out their arm, and how much they would need to be paid to hold out their arm for five minutes. The final three questions were included to test whether tangential immersion distracted participants from the physical sensation of the task. Participants indicated how long they thought they held out their arm (minutes, seconds, milliseconds).[8] The research assistant then told them their actual time and participants entered it into the survey (minutes, seconds, milliseconds). Finally, participants indicated how big their phone is (large screen/small screen), their handedness (right, left, ambidextrous), which arm they held out, and their gender identity (see web appendix for details).

Results

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[7] These instructions were also included in the pretest reading task; participants perceived the reading and pleasant conditions as no different in importance, suggesting these instructions did not influence perceptions of task importance.

[8] This question was initially included in Experiments 2 and 5 to measure perceived (vs. actual) time on task. However, because there was a visible timer on the screen during the task, participants' estimates were highly correlated with the actual time displayed on the screen (experiment 2: $r = .84$, $p < .001$; experiment 5: $r = .79$, $p < .001$). Thus, this measure is not discussed further.

Manipulation Checks. As intended, participants in the pleasant condition ($M = 3.32$) reported the experience as significantly more enjoyable than control ($M = 2.68$; $b = .65$, $t(408) = 3.96$, $p < .001$). Participants in the reading condition ($M = 2.95$) reported the overall experience to be only marginally more enjoyable than control ($b = .27$, $t(408) = 1.64$, $p = .102$). Participants in the pleasant condition also reported the experience to be more enjoyable than participants in the reading condition ($b = .38$, $t(408) = 2.28$, $p = .023$). The immersion and focus measures were significantly correlated ($r = .53$, $p < .001$) and thus collapsed; however, there were no differences between control and the reading or pleasant conditions (ps > .79).

Persistence. As predicted, reading participants ($M = 173$ seconds) persisted significantly longer in the coordination exercise than control ($M = 156$ seconds; $b = 17.17$, $t(408) = 2.09$, $p = .037$; logged: $b = .17$, $t(408) = 2.24$, $p = .026$). On the other hand, persistence did not differ between participants in the control and pleasant conditions ($M = 165$ seconds; $b = 9.17$, $t(408) = 1.13$, $p = .260$; logged: $b = .06$, $t(408) = .76$, $p = .450$).

Pain, Forget, and Pay. Participants reported that it was more painful to hold their arm out in the reading ($M = 4.33$) than control condition ($M = 3.89$; $b = .44$, $t(408) = 2.65$, $p = .008$)—as would be expected given they persisted longer in the task and time on task was significantly correlated with pain ($p = .001$). Reported pain did not differ between the pleasant and control conditions ($M = 3.64$; $b = -.25$, $t(408) = -1.54$, $p = .125$). Participants did not report any differences across conditions in the degree to which they forgot their arm was raised or the amount they would need to be paid to perform the task for five minutes (ps > .23).

Discussion

Experiment 2 generalized the effects of tangential immersion to a low-attention coordination exercise and provided further support that, to increase persistence, consumers must perform an *immersive* secondary task—and that a more enjoyable task (or experience) alone will not increase persistence. Specifically, concurrently performing an immersive tangential task increased the length of time participants held out their arm by more than 10%, whereas a more enjoyable but less immersive task did not increase persistence. Participants across the three conditions reported no differences in the degree to which they forgot they were doing the arm-holding exercise. Moreover, participants in the reading condition reported the exercise as significantly more painful than control (a result that reflects their prolonged performance). These findings suggest increased persistence cannot be explained by dissociation or distraction from the focal task or its physical cues.

The pretest demonstrated that while the pleasant task was the most enjoyable, the reading task was the most immersive. However, when concurrently doing the coordination exercise, participants reported no differences in immersion across conditions. This result may be explained by past research suggesting people are not always aware of their affective reactions (Winkielman and Berridge 2004) or able to accurately report their cognitive processes after making a decision (Nisbett and Wilson 1977). Moreover, by the time they quit the task and reported their level of immersion, it may not have differed across the tasks (similarly to the delay of boredom). In the next study, we hold time spent on task constant to cleanly assess self-reported emotions and perceptions in order to provide additional evidence for the underlying psychological mechanism.

EXPERIMENT 3: TANGENTIAL IMMERSION OCCUPIES EXCESS ATTENTION AND DELAYS BOREDOM

Experiment 3 directly tests whether tangential immersion delays boredom while performing a low-attention task, and whether this is mediated by a reduction in excess attention. If able, consumers will stop a low-attention task when bored—an emotional state we propose is delayed when tangentially immersed. In the previous experiments, participants chose how long to persist, and tangentially immersed participants persisted longer—as such, measuring boredom at the point of quitting resulted in no differences across conditions. In this experiment all participants perform the focal task for a fixed amount of time while either tangentially immersed, or not, allowing us to measure felt boredom at the same point across conditions. We predict that tangential immersion will occupy excess attention during a low-attention task which will consequently reduce feelings of boredom when measured at a fixed interval.

Method

Three hundred ninety three Amazon Mechanical Turk workers completed a study in exchange for payment and passed our preregistered inclusion criteria (51% female, M_{age} = 40.26, SD_{age} = 11.99). Participants read “Life is filled with activities that people should do for longer (e.g., brushing their teeth, exercising, doing chores, etc.). In this study, you will do a task that represents this type of daily activity.” They then learned the task they would do is to type the letters “zm” repeatedly for as long as they could. Participants in the tangential immersion condition were further told that while typing they would also listen to an excerpt from an audiobook. Participants were again given a general goal to persist; however, unlike in the previous studies (and unbeknownst to them ahead of time) they all did the task for a fixed amount of time (three minutes). Aligned with this design, participants read: "We want to see for how long you can persist in this typing task, but ask that you do it for at least three minutes." This instruction was included so as not to surprise participants when they were unable to immediately advance in the study. Participants were randomly assigned to perform the low-attention typing task either while: (1) listening to nothing (control); or, (2) listening to an immersive audio clip (from the book *Divergent*; tangential immersion). In both conditions, participants saw a media player with a 9:53 minute play time and were instructed to press play and begin typing for as long as they could. Participants were reassured that they would receive the same payment no matter how long they did the task. Here and in the following experiment, the control conditions include a timer that displayed the amount of time that passed (similar to the monitoring condition in experiment 1s) to provide the most conservative test of our theory.

A pretest (N = 195) examined whether being tangentially immersed while typing occupied excess attention. Participants followed similar instructions as above, and after two minutes, were asked two items measuring excess attention (r = .73; p < .001): "My attention was fully occupied by the task(s) I was doing" (reversed coded), "My attention was partially somewhere else (e.g., my mind was wandering, I found myself looking around the room, etc.)" (1 = Strongly disagree to 7 = Strongly agree). Results of the pretest reveal that tangential immersion significantly reduced excess attention during the typing task ($M_{immersion}$ = 2.51 vs.

$M_{control}$ = 3.15 vs. *b* = -.63, *t*(193) = -2.44, *p* = .015; see web appendix for pretest details).[9]

In the main study, participants performed the typing task for three minutes, after which they were automatically forwarded to the next page and were asked the two-item pretested scale measuring excess attention. Participants then reported felt boredom: "How bored did you feel while typing "zm?" (1 = Not at all bored to 7 = Extremely bored). Boredom is commonly accompanied by a slowed sense of time (Zakay 2014), whereas fully engaging one's attention makes time seem to pass more quickly (for a review see Grondin 2010). Thus, as a secondary measure of boredom, participants reported their perception of time passage: "How quickly did it feel like time passed while typing "zm?" (1 = Time passed very slowly to 7 = Time passed very quickly). To measure intention to persist, participants were then asked: "How much longer do you think you could have persisted in typing "zm?" (1 = Not much longer to 7 = A great deal longer). Lastly, participants responded to a manipulation check asking whether they listened to any audio while typing and reported their gender and age (see web appendix for details).

Results

Excess Attention (*r* = .84, *p* < .001), *Boredom, Time Perception, and Intention to Persist.* Consistent with our theorizing, tangentially immersed participants (*M* = 2.58) reported less excess attention than control (*M* = 3.05; *b* = -.47, *t*(391) = -2.52, *p* = .012). As predicted, participants in the tangential immersion condition (vs. control) reported the experience as less

[9] The preregistered scale included a third item: "I could have easily done an additional task at the same time without feeling overwhelmed." The difference remains significant using the 3-item scale (*b* = -.42, *t*(193) = -2.11, *p* = .036). However, without this measure, the scale reliability increases from α = .53 to α = .84. Thus, we report the results of the 2-item scale above and preregistered, and asked, only these two measures in the main experiment.

boring ($M_{immersion}$ = 4.75 vs. $M_{control}$ = 5.47; b = -.72, t(391) = -3.85, p < .001), and reported typing-task time to have passed more quickly ($M_{immersion}$ = 3.53 vs. $M_{control}$ = 2.78; b = .75, t(391) = 4.25, p < .001). Moreover, tangentially immersed participants (M = 3.86) anticipated they could have continued typing longer than control (M = 3.33; b = .52, t(391) = 2.58, p = .010).

Mediations. To test whether lower boredom in the tangential immersion condition was driven by less excess attention, we conducted a mediation analysis with 1,000 bootstrapped samples (Hayes 2013). Condition served as the independent variable (1 = tangential immersion vs. 0 = control), excess attention as the mediating variable, and boredom as the dependent variable. Consistent with previous findings (Westgate and Wilson 2018), excess attention mediated the effect of tangential immersion on boredom (95% CI [-.27, -.04]). A second mediation analysis demonstrated that excess attention also mediated the effect of tangential immersion on time perception (95% CI [.02, .22]). A third mediation analysis confirmed that boredom mediated the effect of tangential immersion on intention to persist (95% CI [.17, .53]).

Error Rate. To test whether tangential immersion impacted performance, we calculated a rate of typing errors using an algorithm in R designed to identify errors in the text sequence. Specifically, we counted the number of "zm" combinations typed and subtracted it from the total number of pairs in the text sequence (i.e., we counted the number of erroneous pairs and subtracted that from the total number of pairs typed to calculate the proportion of pairs which contained an error). Error rate was no different in the tangential immersion condition (M = 3.91) versus control (M = 4.21; b = -.30, t(391) = -.30, p = .761).

Discussion

Our theory suggests tangential immersion delays boredom. As such, participants in experiments 1-2 likely stopped the low-attention task when they felt bored (a state they reached more slowly when tangentially immersed)—resulting in no differences in reported boredom after quitting. In contrast, in experiment 3, participants performed the task for the same length of time across conditions, allowing us to cleanly compare levels of boredom, and excess attention, at a set timepoint. The results suggest that low-attention behaviors leave excess attention that leads to feelings of boredom and reduced intentions to persist. However, having this excess attention engaged in a tangential task reduces boredom and increases intentions to persist in the low-attention behavior. These findings are consistent with previous evidence suggesting that failure to engage attention underlies attentional boredom (Westgate and Wilson 2018), and can help to explain why, when bored, people may naturally try to engage their attention in other ways.

EXPERIMENT 4: TANGENTIAL IMMERSION INCREASES PERSISTENCE ONLY FOR LOW-ATTENTION BEHAVIORS

Experiment 4 tests our proposition that adding attentional demands via a tangential task increases persistence only when the focal task is low attention, thus leaving excess resources that can attend to the tangential task. In this experiment, participants perform a focal typing task that ranges in attentional demands (from low to high) while either tangentially immersed or not. We predict a main effect of task attentional demands—such that participants will naturally persist longer in higher-attention tasks—and, most importantly, that tangential immersion will increase persistence only when the focal task demands low levels of attention.

Method

Six hundred eighty six undergraduates from a large West Coast University completed the study as instructed in exchange for course credit and passed our preregistered inclusion criteria (54% female, M_{age} = 20.81, SD_{age} = 2.12).[10] Participants read similar instructions as experiment 3 and were assigned to one of three focal typing tasks that varied in attentional demands: (1) low-attention (typing “zm” repeatedly); (2) medium-attention (typing the alphabet forward then backward repeatedly); (3) and, high-attention (typing words that begin with each letter of the alphabet, and starting again when they reached Z without repeating any words). Further, half of the participants were randomly assigned to listen to an immersive clip while typing (tangential immersion), while half were simply shown a timer and listened to nothing (control). Participants in the tangential immersion conditions listened to an excerpt from an audio version of *The Hobbit*. Participants saw a media player with a 15:01 minute play time and were instructed to press play and begin typing for as long as they could, and to press next when they wished to move on.

After the typing task, they responded to several items measuring their experience and perceptions of the focal task (boredom and enjoyability). To test our manipulation of the tasks’ attentional demands, participants were asked: “How effortful was the typing task?” and “To what extent did it feel like you were typing on autopilot?” on sliding scales (1 = Not at all to 7 = Very [Very much]). To measure engagement in the story, participants were asked the extent to which

[10] One person wrote in an age of 40,888 and thus their age was removed when calculating the average age.

they were curious to hear how the clip ended (1 = Not at all to 7 = Very). Finally, participants responded to a comprehension check, whether they have ever read or listened to *The Hobbit*, their gender identity, age, and how well they speak English (see web appendix for details).

Results

Manipulation Checks. We regressed each of the manipulation checks on dummy-coded task (low-, medium-, high-) among control participants.[11] Relative to the low-attention task (M = 2.58), the medium- (M = 4.26) and high-attention tasks (M = 4.20) were significantly more effortful (bs = 1.68 and 1.62, ts(336) = 7.88 and 7.31, ps <.001, respectively). Similarly, compared to the low-attention task (M = 5.30), the medium- (M = 3.89) and high-attention tasks (M = 3.45) were significantly less automatic (bs = -1.41 and -1.85, ts(336) = -6.31 and -8.02, ps < .001, respectively). However, the medium-attention task was no different in effortfulness than the high-attention task (p = .767), and was marginally more automatic (b = 0.44, t(336) = 1.96, p = .051). These manipulation checks suggest two general levels of attentional demands: the two high(er) attention tasks demanded more attention than the low-attention task, but did not meaningfully differ in attentional demands from each other.

Consistent with the two general levels of attentional demands, among tangentially immersed participants, those who did the low-attention task reported greater curiosity about the story (M=2.82) than those who did the high(er)-attention tasks (medium- and high- attention collapsed; M= 2.37; bs = .45, t(345) = 2.12, p = .035), suggesting that the low-attention task

[11]Of note, while the preregistration did not specify that these two measures would be assessed only among control participants, doing so provides a cleaner test of our focal task manipulation.

indeed left excess attention that was then available to become immersed in the audiobook. Moreover, persistence in the focal typing task was significantly correlated with curiosity in the tangential audio task (b = 18.92, t(345) = 3.64, p < .001).

Insert figure 2 about here

Persistence. Consistent with our preregistered analysis, and supported by the manipulation checks, we first examined the interaction between the low- versus high(er) attention tasks with a complete set of orthogonal contrast codes.[12] Specifically, we regressed time spent typing on low- versus high(er)-attention tasks (low-attention = 2 vs. medium-attention = -1 vs. high-attention = -1), medium- versus high-attention task (low-attention = 0 vs. medium-attention = -1 vs. high-attention = 1), tangential immersion (control = -1 vs. tangential immersion = 1), the interaction between immersion and the low versus high(er)-attention tasks, and the interaction between immersion and the medium- versus high-attention task. The analysis revealed an interaction between tangential immersion and the low versus high(er)-attention tasks (b = 8.56, t(680) = 1.86, p = .064; logged: b = .06, t(680) = 2.33, p = .020), and no interaction between the medium- and high-attention tasks (p = .797; logged: p = .830). Further, there was a

[12] We consulted a statistical expert after preregistration who recommended this analytic approach. Our preregistered analysis plan proposed a linear regression with the following predictors: (1) dummy variable for task (low- vs. high), (2) dummy variable for tangential immersion (immersive vs. control), (3) interaction of task and tangential immersion. We thus regressed typing time on dummy-coded task (low-attention = 1 vs. medium-attention = 0 vs. high-attention = 0), immersion (control = 0 vs. tangential immersion = 1), and their interaction. This analysis also reveals an interaction between task and tangential immersion for the low vs. high(er) attention tasks (b = 48.31, t(682) = 1.72, p = .087; logged: b = .31, t(682) = 2.14, p = .033).

significant main effect of condition between the low- (M = 117 seconds) versus high(er)-attention tasks (M = 209 seconds; b = -31.89, $t(680) = -6.91$, $p < .001$; logged: b = -.21, $t(680)$ = -9.06, $p < .001$), as well as between the medium- (M = 168 seconds) versus high-attention tasks (M = 253 seconds; b = 42.33, $t(680) = 5.12$, $p < .001$; logged: b = .27, $t(680) = 6.31$, $p < .001$). There was no main effect of tangential immersion ($M_{immersion}$ = 183 vs. $M_{control}$ = 169 seconds; p = .242; logged: p = .257).

We extracted simple effects for typing time using an equivalent version of the regression above but with dummy-coded variables. Specifically, we dummy coded the three focal tasks (low-, medium-, high-), as well as tangential immersion (control = 0 vs. tangential immersion = 1). We included only two of the dummy coded variables in the model at any one time to extract different sets of simple effects. As predicted, there was a significant simple effect of tangential immersion within the low-attention conditions ($M_{immersion}$ = 139 seconds vs. $M_{control}$ = 90 seconds; b = 49.79, $t(680) = 2.24$, $p = .025$; logged: b = .30, $t(680) = 2.62$, $p = .009$). In contrast, there were no simple effects of tangential immersion within the medium- ($M_{immersion}$ = 165 seconds vs. $M_{control}$ = 171 seconds; b = -5.84, $t(680) = -.25$, $p = .800$; logged: b = -.05, $t(680) = -.44$, p = .663) or high-attention conditions ($M_{immersion}$ = 254 seconds vs. $M_{control}$ = 251 seconds; b = 2.69, $t(680) = .11$, $p = .910$; logged: b = -.01, $t(680) = -.12$ $p = .902$). Compared to the low-attention control condition (M = 90 seconds), there were significant simple effects of the medium- (M = 171 seconds) and high-attention control conditions (M = 251 seconds; bs = 81.14 and 161.54, $ts(680)$ = 3.58 and 6.88, $ps < .001$; logged: b = .55 and 1.07, $ts(680)$ = 4.73 and 8.86, $ps < .001$; see figure 2).

Error Rate. To test whether tangential immersion impacted performance, we calculated a rate of typing errors using an algorithm in R designed to identify errors in the text sequences within each task.[13] In the low-attention conditions, we used the same algorithm described in experiment 3. In the medium-attention conditions, we followed a similar logic using a-z and z-a sequences. In the high-attention conditions, we counted errors as the first letter of each word deviating from an a-z sequence (to not compound error rates, the algorithm recognized skipped words as just one error). Tangential immersion did not increase error rates for participants in the low- ($M_{immersion}$ = 2.91 vs. $M_{control}$ = 3.61; b = -.70, t(242) = -.72, p = .471), medium- ($M_{immersion}$ = 2.28 vs. $M_{control}$ = 2.32; b = -.04, t(217) = -.06, p = .949), or high-attention ($M_{immersion}$ = .21 vs. $M_{control}$ = .17; b = .04, t(205) = 1.01, p = .313) conditions.

Self-Reported Perceptions. We ran the complete orthogonal contrast codes model above with perception measures as the dependent variables. We further used the dummy coded models with perception measures as the dependent variables to extract simple effects. For the 3-item boredom scale (α = .70), there was a significant main effect of condition between the low- (M = 4.95) versus high(er)-attention tasks (M = 4.42; b = .17, ts(680) = 4.52, p < .001). There was no main effect between the medium- and high-attention tasks (p = .986), no main effect of tangential immersion (p = .770), and no interactions (ps > .44). There were no simple effects of tangential immersion (ps > .47).

For the single sliding scale item measuring how fun the task was (boring to fun), there was a significant main effect between the low- (M = 2.96) versus high(er)-attention tasks (M = 3.68; b = -.25, ts(680) = -4.26, p < .001), as well as between the medium- and high-attention

[13] For the algorithms to run properly, participants who chose not to type any characters had to be excluded (this excludes 16 participants total).

tasks ($M_{medium\text{-}attention}$ = 3.22 vs. $M_{high\text{-}attention}$ = 4.18; b = .47, t(680) = 4.42, p < .001). There was a main effect of tangential immersion ($M_{immersion}$ = 3.59 vs. $M_{control}$ = 3.26; b = .17, t(680) = 2.02, p = .044). There were no interactions (ps > .17). There was a simple effect of tangential immersion in the medium-attention conditions ($M_{immersion}$ = 3.60 vs. $M_{control}$ = 2.88; b = .71, t(680) = 2.41, p = .016), but not in the low- or high-attention conditions (ps > .51).

A similar pattern emerged on the task-enjoyability scale (fun and enjoyability collapsed [r = .91, p < .001]): there was a main effect between the low- (M = 2.37) versus high(er)-attention tasks (M = 2.81; b = -.15, t(680) = -3.68, p < .001), as well as between the medium- and high-attention tasks ($M_{medium\text{-}attention}$ = 2.48 vs. $M_{high\text{-}attention}$ = 3.16; b = .34, t(680) = 4.51, p < .001). There was no main effect of tangential immersion (p = .236) and no interactions (ps > .21). There were no simple effects of tangential immersion (ps > .07).

These results suggest that the low-attention task was more boring and less fun than the high(er)-attention tasks and that the high-attention task was more fun and enjoyable than the medium-attention task. Thus, although the manipulation checks show that the high- (vs. medium-attention) task was no more effortful and only marginally less automatic, this pattern of results reveals that it was considered more fun—suggesting the medium- and high-attention tasks do not differ with respect to their *attentional demands,* but that listing out words is more fun and interesting than typing the alphabet forward and backward (indeed, it may feel more like a game).

Discussion

Experiment 4 provides support for our first predicted boundary condition: tangential immersion increases persistence only when the focal task requires low levels of attention. We found that tangential immersion increased persistence among participants who did a low-attention typing task, but did not affect persistence when the typing task demanded more attention. Further, engagement in the tangential task (as measured by piqued curiosity) was lower when the focal task required more attention. This finding may suggest that while doing the higher-attention tasks, participants employed (and maintained) endogenous, goal-directed attention (i.e., top-down attention) to the focal task and tuned out the audio (as they did not have any excess attention to attend to it)—especially as they were specifically given a goal to persist in the typing task. This might be one explanation as to why there was not a decrease in persistence in the higher-attention tasks when they were coupled with a tangential task (i.e., participants focused on the typing and did not allocate attention to the audiobook, and thus total task demands did not exceed their capacity).

Similar to the previous experiments, among participants who did the low-attention task, there was no effect of tangential immersion on self-reported boredom—further supporting our theory that they quit when they were bored, but that they reached this stage later when tangentially immersed. Compared to the low-attention task, participants reported the higher-attention tasks as more effortful, less automatic, less boring, and more fun—and, consistent with this, participants naturally persisted in them longer. Further, although the medium- and high-attention tasks did not differ in attentional demands, the high-attention task was rated as more fun. This may be one explanation why participants naturally persisted longer in the high- (vs. medium) attention task.

EXPERIMENT 5: TANGENTIAL IMMERSION ONLY INCREASES PERSISTENCE IF IT DOES NOT EXCEED ATTENTIONAL CAPACITY

Experiment 5 tests our second proposed boundary: tangential immersion will only increase persistence when the tangential task does not demand so much attention that total attentional demands exceed capacity. In experiment 5, participants perform the low-attention coordination exercise from experiment 2 while concurrently doing a task with various levels of attentional demands. We predict that, relative to control, concurrently doing a task that demands moderate attention will increase persistence in the coordination exercise, but that persistence will not increase (and may even decrease) when the tangential task demands very high levels of attention.

Method

This study ran in the behavioral laboratory of a large West Coast University for one week. One hundred seventy six undergraduates participated in exchange for course credit. Participants followed the same protocol as experiment 2 but were randomly assigned to one of four tangential tasks: watch a dot scrolling across a computer screen (control); listen to a story (listening); read a story scrolling across a screen (reading); add a list of single digit numbers scrolling across a screen (addition). These tangential tasks were designed such that they varied in attentional demands: the control task demanded very little attention; the listening and reading tasks demanded more attention than control; and the addition task demanded very high levels of focused attention.

A pretest supported this design. Participants (N = 394) performed one of the four tasks for one minute and then responded to the same 3-item immersion scale as in the experiment 2 pretest (α = .90). The pretest revealed that, relative to control (M = 3.26), participants reported the listening (M = 5.23), reading (M = 5.15), and addition (M = 6.15) tasks as more immersive (bs = 1.96, 1.89, and 2.89, ts(390) = 9.16, 8.84, and 13.66, ps < .001, respectively). There was no difference in immersiveness between the listening and reading conditions (b = .08, t(390) = .35, p = .723). Finally, participants reported the high-attention addition task as significantly more immersive than all other tasks (ps < .001; see web appendix for pretest details).

Both the control and reading conditions were the same as experiment 2; the media clip for all conditions had a 3:48 playtime; and the reading and listening conditions contained the same content (a short story called *A Saint and a Criminal*). To increase the likelihood that participants paid attention to the tangential task, participants in the reading [and listening] condition were told they would be asked a few questions about the content of what they read [heard], and participants in the addition condition were told they would be asked to report the total number they summed. These questions were designed to encourage participants to attend to the tangential task—this is an important aspect of this design, as we wanted participants to do their best to attend to both tasks in this experiment and not simply filter out the tangential task if it required more attention than they had available (as appeared to be the case when performing the high-attention focal tasks in the previous experiment). Participants were informed that those who persisted longer than average would be entered into a lottery to win $25, giving participants an additional reason to persist. After persisting as long as they could, they answered the same manipulation checks, perceptions questions, and robustness checks as in experiment 2.[14]

Results

Manipulation Checks. The items measuring immersion and focus were highly correlated and thus collapsed into a single measure of immersion (r = .69; p < .001). There was no difference on this measure between the control (M = 3.51) and listening conditions (M = 3.14; b = -.37, t(172) = -1.30, p = .197). On the other hand, participants in the reading condition (M = 4.08) reported being significantly more immersed than participants in both the control and listening conditions (bs = .57 and .93, ts(172) = 2.00 and 3.32, ps = .047 and =.001). Participants in the addition condition (M = 4.85) reported being significantly more immersed than participants in the control, listening, and reading conditions (bs = 1.33, 1.70, and .77, ts(172) = 4.63, 5.94, and 2.68, ps <.001, <.001, and = .008, respectively).

Persistence. Consistent with our theory, and with the results of the pretest, participants in the reading condition persisted significantly longer (M = 194 seconds) than control (M = 165 seconds; b = 29.11, t(172) = 2.09, p = .038; logged: b = .21, t(171) = 1.78, p = .077).[15] Relative to control, participants persisted longer in the listening condition (M = 181 seconds) and for less time in the addition condition (M = 147 seconds), though neither difference reached significance (bs = 16.09 and -17.74, ts(172) = 1.16 and -1.25, ps = .249 and .212; logged: bs = .18 and -.11, ts(171) = 1.57 and -.96, ps = .117 and .338; see figure 3). Finally, participants in the addition

[14] In experiment 5, participants were not asked to report how painful the task was.
[15] One participant has a time of 0 seconds listed. This participant was removed only for the logged time analysis.

condition persisted for significantly less time than participants in the reading condition (b = -46.86, $t(172) = -3.33$, $p = .001$; logged: $b = -.32$, $t(171) = -2.73$, $p = .007$).

Insert figure 3 about here

Enjoyment, Forget, and Pay. Participants in the reading condition ($M = 3.44$) reported the overall experience as more enjoyable than control ($M = 2.80$; $b = .65$, $t(172) = 2.11$, $p = .036$). Participants in the addition condition ($M = 3.33$) reported the task as marginally more enjoyable than control, while participants in the listening condition ($M = 3.13$) reported no differences in enjoyability versus control (*bs* = .54 and .34, *ts*(172) = 1.72 and 1.10, *ps* = .087 and .273). Relative to control ($M = 2.52$), participants in the addition condition ($M = 3.38$) were more likely to report forgetting they were holding out their arm ($b = .86$, $t(172) = 2.50$, $p = .013$). There was no difference on this measure between control and the reading ($M = 2.91$) or listening conditions ($M = 2.47$; *bs* = .39 and -.06, *ts*(172) = 1.15 and -.17, *ps* = .251 and .868). There was no difference in amount participants would require to be paid across conditions ($M_{Control}$ = \$14.02; M_{Listen} = \$13.93; $M_{reading}$ = \$12.67; $M_{addition}$ = \$14.24; *p*s > .40).

Discussion

Experiment 5 demonstrates that participants persist longer in a low-attention coordination exercise when they are tangentially immersed in a task that sufficiently engages excess attention but does not demand so much attention that total attentional demands exceed their capacity. Specifically, participants who concurrently read a story held their arm out longer than participants who concurrently performed a task that demanded little, if any, attention (staring at a scrolling dot) as well as participants who did a high attention-demanding task (performing addition). Contrary to our prediction, the increase in persistence for the listening task did not reach significance—however, this may have been the result of the study being underpowered.

Notably, only participants who did the high-attention tangential task (addition) were more likely than control to report forgetting they were holding out their arm. This finding further supports our theory that the addition required so much attention that participants no longer had attentional resources available to devote to the coordination exercise—likely leading them to stop sooner. These results also provide support for our proposition that persistence was not driven by attentional distraction, in the typical sense. That is, if persistence were increased by drawing attention away from the focal task, then we would expect that the high-attention task—the only task that reduced awareness of the focal task—would have increased persistence. However, we found that addition participants did not persist longer than control. Finally, we found that participants rated the addition condition as marginally *more* enjoyable than control (and no different than reading), reducing concerns that participants stopped the addition task early out of frustration or dislike for the task.

GENERAL DISCUSSION

Extending performance duration in many low-attention behaviors has the potential to greatly improve consumer well-being. Drawing on boredom and resource-matching theories, the current research offers a framework examining one reason why consumers exhibit poor persistence as well as an approach on how to improve it. We propose an attention-matching framework for persistence, suggesting that when performing a low-attention behavior, concurrently performing a second task that engages *excess* attention will improve the match between attentional demands and available resources and increase persistence in the low-attention behavior. Across a series of experiments, we demonstrate that being tangentially immersed while performing a low-attention behavior occupies excess attentional resources, thereby delaying boredom (experiment 3) and increasing persistence (experiments 1-2, 4-5). Further, using various tangential tasks (reading, listening, watching) and across a range of low-attention behaviors (toothbrushing, typing, coordination exercise) we provide evidence that tangential immersion increases persistence beyond common approaches, such as monitoring one's progress (experiment 1s) and increasing enjoyment without sufficiently increasing attentional demands (experiment 2). Because attentional resources are limited, we propose a sum-level model of attention such that together the two tasks approach, but do not exceed, attentional capacity, leading to two boundary conditions. First, persistence only increases when the focal behavior requires minimal attention—leaving sufficient attention to become immersed in the tangential task (experiment 4). Second, persistence only increases when the tangential task sustains attention without exceeding one's capacity (experiment 5).

Experiment 1s (see web appendix) addresses several alternative explanations. First, across experiments, our control conditions involved a tangential task, thus we added a pure control condition. Second, we compared tangential immersion to a condition in which participants are given a common monitoring tool—a timer—to help them track how long they do the task. Finally, we included a condition in which participants only do the tangential task (i.e., listen to an audiobook). Results demonstrated that participants given a timer to track their progress persist longer in a low-attention behavior relative to control, but that tangential immersion increases persistence beyond monitoring. Further, tangentially immersed participants persist longer than participants who only listen to the audiobook, suggesting that persistence cannot be explained by believing that to continue listening they must also continue typing (i.e., a required bundling of the two behaviors; Kirgios et al. 2020; Milkman et al. 2014).

Theoretical Contributions

The current research makes several key theoretical contributions. First, it offers a new framework that sheds light on many common consumer persistence-failures. Building on resource-matching theory, which suggests the processing demands of a single stimulus can be more (or less) optimally matched to a consumer's processing capacity, we propose an attentional-resource-matching model for persistence. Based on our model, we demonstrate that for low-attention behaviors, tangential immersion increases persistence beyond monitoring one's behavior (Bravata 2007) or making the experience or task itself more enjoyable (Woolley and Fishbach 2016). Moreover, based on the limits of attentional capacity, our framework offers important insights as to when—and how—adding attentional demands can increase persistence, and when it can have little effect or even be detrimental. It is critical to understand these distinctions in order to implement effective behavior-change interventions.

The current research also contributes to the consumer habit and health and well-being literature. Much of the previous literature focuses on *initiation* of behaviors (e.g., how to increase the likelihood people *begin* a behavior; Gollwitzer and Schaal 1998; Wood and Rünger 2016) but does not examine the *duration* of in-period persistence. We investigate ways to increase how long consumers engage in the behavior once it has begun, a critical component for behavior change as the duration of many behaviors is directly proportional to how beneficial they are. This extension is particularly relevant for temptation bundling (Kirgios et al. 2020; Milkman et al. 2014). Milkman et al. (2014) demonstrate that consumers who commit to only doing a "want" behavior when coupled with a "should" behavior initiate the behavior more frequently. Our research extends this finding by examining how, and why, dual tasking increases *in-period persistence* in the should behavior.

Our research also contributes to the consumer experience literature by highlighting scenarios in which consumers are likely to experience boredom (and thus have a worse experience) and by providing suggestions on how to attenuate it. Consumer experience is a key driver of happiness and well-being (Van Boven and Gilovich 2003). The paucity of research on boredom during consumer experiences is somewhat surprising given that the majority of consumers report frequently experiencing boredom (Chin et al. 2017) and lack of engagement has important implications for consumer behavior (Zane, Smith, and Reczek 2020) and well-being (Killingsworth and Gilbert 2010). Our research demonstrates that merely making a task (or experience) more pleasant or enjoyable is not enough to eliminate attentional boredom—rather, immersing consumers in a task that engages their excess attention is more likely to delay boredom, resulting in better, prolonged experiences. In experiments where participants could persist as long as they chose, we found no differences in self-reported boredom. These findings support our theory that boredom was delayed; however, it is worth noting that additional factors could also have contributed to these null results. Future research could look more closely at the connections between task perceptions and boredom, for example, as well as more deeply examine the mechanisms that delay the onset of boredom.

Fourth, we contribute to the distraction literature by expanding the definition of distraction and providing new insights as to how, and why, stimuli that draw attention can increase persistence. Past research defines distractions as stimuli that pull attention away (i.e., "distract") from something else (Zane et al. 2020). In contrast, we introduce a special type of distraction—a concurrent stimulus that occupies *excess* attention and thus does not decrease attention to a focal task. These insights broaden our understanding of distractions and introduce a range of contexts in which distractions may be beneficial (vs. detrimental). These findings also have implications for the exercise and pain literature—whereas previous work focuses on distractions reducing awareness of physical sensations (Eccleston and Crombez 1999; Masters and Ogles, 1998; Pennebaker and Lightner 1980), the current research contributes a distinct mechanism suggesting that adding attentional demands during low-attention exercise can also delay boredom and increase persistence. As such, tangential immersion is likely to increase persistence in a wide-range of low-attention exercises such as walking, or even running for experienced athletes for whom running would be classified as low-attention.

Finally, we advance the dual-tasking literature by demonstrating a case in which dual tasking has positive and important implications. While dual tasking is often discouraged because of its potential cost to performance (Pashler 1984, 1994), we demonstrate a context in which dual tasking can have positive implications by delaying boredom and increasing persistence. While we did not find any differences in performance accuracy, it is possible that dual tasking during some low-attention behaviors may come with small performance costs. However, small decrements (often characterized by delays of milliseconds)—should they occur—would not be of large concern as any minimal costs to performance are likely outweighed by the advantages provided by performing the behaviors for longer. We also build on recent work on the positive consequences of the *perceptions* of dual tasking—specifically, Srna, Schrift, and Zauberman (2018) found that in some cases consumers can actually increase their performance by merely *perceiving* the same exact task as multitasking. The current work also paves the way for a host of future research (see discussion in web appendix).

Practical Contributions

By offering critical insights about which approaches or products are most likely to increase persistence in low-attention behaviors, our research also provides practical contributions to consumers, companies, and service providers. First, not only does it offer an explanation as to why consumers commonly dual task—but it also suggests that, when doing so, consumers should carefully consider their choice of focal task and tangential task. For instance, while many people have an intuition to listen to something when doing "boring" tasks or going for a walk, there are other low-attention behaviors for which adding a secondary task may be somewhat less intuitive, such as toothbrushing. Moreover, they may not always realize that *what* they choose as a secondary task is key for persistence. Indeed, we show that it is not enough to just "do two things at once," or to simply choose a tangential task that is pleasant (e.g., listening to music). Rather, what is most important is choosing a task that sufficiently engages excess attention and pairing it with a beneficial low-attention task.

This research also provides insights that product developers and service providers can use to bundle certain products together—and be aware of which bundles to avoid! For instance, many electric toothbrush companies offer phone apps that pair with brushing. Rather than simply including timers, informational interventions, and reward programs (all commonly used tactics), they could include short two-minute immersive soundbites that engage excess attention while brushing (and avoid soundbites that are so immersive, such as high-suspense stories, that they occupy complete attention and pull attention away from brushing). Companies could also promote bundling products together and suggest activities that vary in how much attention they demand based on the focal task. Nike Run Club, for example, could offer different levels of immersive experiences depending on the attention required by the focal activity (which could vary both by activity and by a person's level of expertise).[16] Similarly, consumer packaged goods companies could encourage their customers to become tangentially immersed while using their cleaning products—for instance, P&G could promote a new podcast and encourage consumers to listen while cleaning their house, as the current findings suggest consumers would clean for longer (and thus use more cleaning product).

Finally, managers could encourage workers to bundle rote tasks with a concurrent task to prevent boredom and increase how long they persist (e.g., providing employees with headphones and an engaging audiobook while filing papers). Further, companies could consider environmental interventions to improve the health behaviors of their employees. For instance, companies might consider installing screens above the sinks in company restrooms to encourage employees to wash their hands for longer.

In sum, this research presents an attention-matching theory and intervention to increase persistence in low-attention behaviors. We propose that failures to persist in many behaviors occur because the behaviors demand less attention than consumers have available, leading them to experience boredom and stop prematurely. Thus, we suggest that engaging and sustaining

[16] We thank an anonymous reviewer for this excellent example.

consumers' excess attention in a tangential task will improve the match between attentional demands and available attentional resources, consequently increasing persistence in low-attention behaviors. In doing so, we shed light on why consumers often prematurely stop behaviors that would benefit from persistence, and provide a simple—and low-cost—intervention to prolong them.

DATA COLLECTION PARAGRAPH

The first author supervised the collection of data by research assistants and the lab manager at the Atkinson Behavioral Lab, Rady School of Management for experiment 1 (January 2020), experiment 2 pretest (online lab; January 2021), experiment 2 (April-May 2019), experiment 4 (October-November 2019), and experiment 5 (March 2019). The first author supervised the collection of data on Amazon Mechanical Turk for the experiment 1 pretest (January 2020), experiment 1s (presented in the web appendix; July 2020), experiment 3 pretest (August 2021), experiment 3 (August 2021), experiment 4s (presented in the web appendix; October 2019), and experiment 5 pretest (August 2021). These data were analyzed by the first author under the guidance of the second and third authors. The data are currently stored in a project directory on the Open Science Framework.

APPENDIX

TABLE A1

SUMMARY OF SELECTED RELEVANT RESEARCH

Manuscript	Focal task	Secondary task	Dependent variable	Relevant findings
Woolley and Fishbach 2016 (Study 4)	Math problems	Immediate rewards received (vs. control)	Number of math problems attempted	By making schoolwork more fun, students who received several immediate rewards (listening to background music, using colored pencils, eating snacks) while doing an in-class assignment, attempted more math problems than students who did not.
Kirgios et al. 2020; Milkman, Minson, and Volpp 2014	Going to gym	Listening to audiobook at gym	Likelihood of going to gym	Participants were more likely to go to the gym when going to the gym was bundled with listening to an indulgent audiobook (i.e., temptation bundling).
Sansone et al. 1992	Letter matrices varying in interestingness and reason to persist (i.e., a heath reason)	No tangential task	Suggested strategies to increase interestingness; strategies used; number of matrices requested	Participants who did the less- (vs. more) interesting task(s) were more likely to suggest context changes (e.g., playing music) would enhance task interestingness. Participants were more likely to engage in strategies to make a task more interesting when their focal task was less interesting, a relevant strategy was available, and there was a reason to persist. Engaging in these strategies correlated with requests for additional tasks.
Srna, Schrift, and Zauberman 2018	Task framed as single tasking or multitasking	No tangential task	Amount attempted; quality of performance; time spent	Across 32 studies, participants who perceived a task as multitasking (vs. single tasking) performed better (including performing a greater amount of the task, performing the task more accurately, being more engaged with the task, and sometimes, but not always, persisting in it longer).
Andrade 2010	Listening to monotonous phone call	Doodling (vs. control)	Monitoring and recall	Participants who doodled while listening to a monotone telephone call performed better on a monitoring task and on a surprise recall test asking them about information from the call.
Chinchanachokchai,	Listening to ad	Low-load task	Memory of ad	When listening to a mundane ad, concurrently performing

Duff, and Faber 2019 (Study 2)	with monotone (vs. interesting) narration style	(easy visual search task) vs. high-load task (difficult visual search task) vs. control	content; self-reported mind wandering	a low-load visual search task increased memory scores compared to doing a high-load visual search task or not doing a secondary task. Participants who did a high-load task also scored higher than those who did no task. Participants who did a low-load task while listening to the mundane ad reported less mind wandering than those who did no task, which mediated the effect of task on ad recall. Performing a secondary task did not affect memory or self-reported mind wandering when listening to the interesting ad.
Zane, Smith, and Reczek 2020	Varied focal tasks (e.g, coloring, browsing internet)	Background advertisement	Interest in ad	When participants perceived themselves to be relatively distracted by an ad, they inferred greater interest in the ad and consequently reviewed the brand more positively.
Damrade-Frye and Laird 1989	Listening task	Low-volume TV (moderate distraction) vs. loud TV (high distraction) vs. control	Boredom	Participants who were distracted from the focal task but did not recognize the cause (i.e., low-volume tv), were more likely to misattribute their inattention to the focal task material (vs. to the distraction).
Dascal et al. 2017; Malloy and Milling 2010	Medical procedures	Virtual reality distractor	Pain	Using virtual reality to distract attention during some unpleasant medical procedures reduced felt pain.
Hodes et al. 1990; McCaul and Haugtvedt 1982; McCaul and Mallott 1984	Painful task	Distractor task	Self-reported pain/distress	Distractor tasks sometimes reduce pain by pulling attention away from the painful task (though this is context specific and depends on whether early or late in process).
Bellisle, Dalix, and Slama 2004; Blass et al. 2006; Braude and Stevenson 2014	Eating	Watching TV (or listening to a story) vs. control	Amount consumed; ratings of satiety, hunger, and palatability	Participants ate more when watching tv (or listening to audio) versus when only eating. This may have been due to participants being less aware of their internal states (e.g., satiation) when distracted by the television.
Lind, Welch, and Ekkekakis 2009; Masters and Ogles 1998	Exercise	Distractors (associative vs. dissociative)	Perceived effort; pace; enjoyment	Dissociative strategies are sometimes associated with an increase in affective response and a decrease in perceived effort (but may come at the cost of reducing speed/pace of performance). Associative strategies may help regulate intensity. Results are mixed.

Terry et al. 2020	Exercise	Music	Four response categories: physiological; psychological; psychophysical; performance outcomes	A meta-analysis of 139 physical activity studies found associations between music and (1) increased affective valence, (2) increased physical performance, (3) decreased perceived exertion, (4) improved physiological efficiency. These effects were moderated by type of exercise and music tempo.
Overstreet et al. 2018; Rider et al. 2016	Exercise	TV	Enjoyment	Watching TV while exercising increased enjoyment. In one study, participants focused less on walking when watching TV.
Fisher 1998	Simple low-attention task (manual assembly) vs. simple high-attention task (proof reading) vs. complex task (in-basket for advertising manager)	Interruptions (irrelevant or concern-relevant) vs. control	Boredom; mind wandering; inattention	During a 20-minute task, interruptions reduced boredom, boredom symptoms, mind wandering, and inattention when the task was simple and low-attention; interruptions did not affect boredom when the task was simple but high-attention or complex.

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TABLE 1

EXAMPLES OF COMPANIES, PRODUCTS, AND SERVICES THAT SUFFER FROM POOR CONSUMER PERSISTENCE

Behavioral category	Type of company	Examples of underutilized products & services
Physical activity	Fitness centers/gyms	Time spent at gym
Physical activity	Fitness equipment	Treadmill, elliptical, stationary bikes
Physical activity	Fitness attire	Running shoes, yoga pants, fitness tops
Physical activity	Fitness apps	Running apps (e.g., Nike Run Club, Strava)
Physical activity	Physical therapy	Persistence in assigned exercises
Well-being	Healthy behavior apps	Apps that log behaviors (e.g., food, sleep logs)
Well-being	Well-being apps	Apps with exercises to improve well-being (e.g., Calm)
Hygiene	Oral hygiene	Toothbrushes, water flossers, floss, mouthwash
Hygiene	Hygiene products	Razors, hairbrushes, nail files, face wash, soap
Chores	Cleaning tools	Vacuums, brooms, mops
Chores	Cleaning supplies	Spray cleaner, dish soap, laundry soap
Chores	Cooking tools	Salad spinner, vegetable peeler, fruit wash
Chores	Gardening supplies	Soil, lawn mowers, plants
Entertainment	Gaming	Games or apps (e.g., Candy Crush Saga)
Entertainment	Media	Noncomplex TV shows or podcasts

FIGURE 1

SUM ATTENTIONAL DEMANDS AND TASK PERSISTENCE

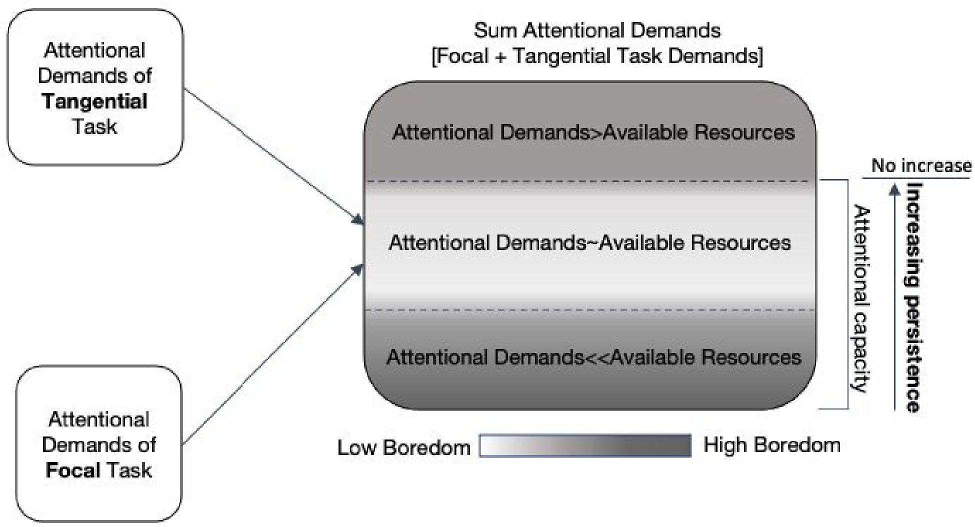
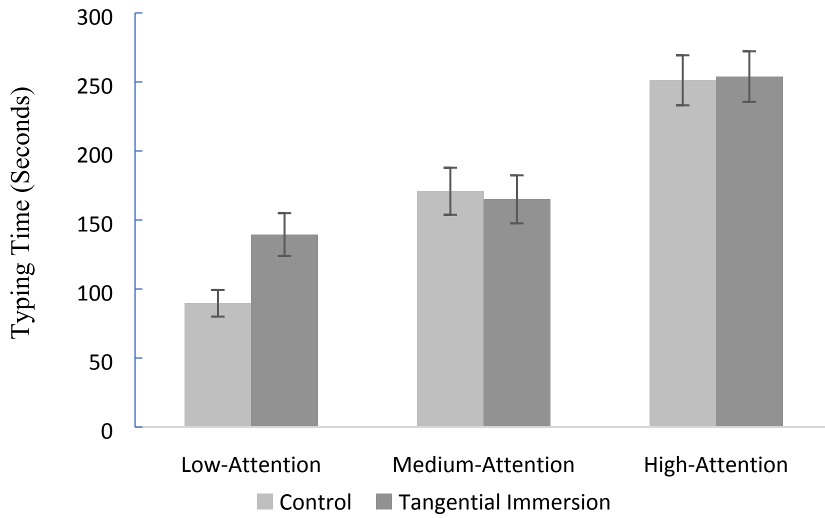


FIGURE 2

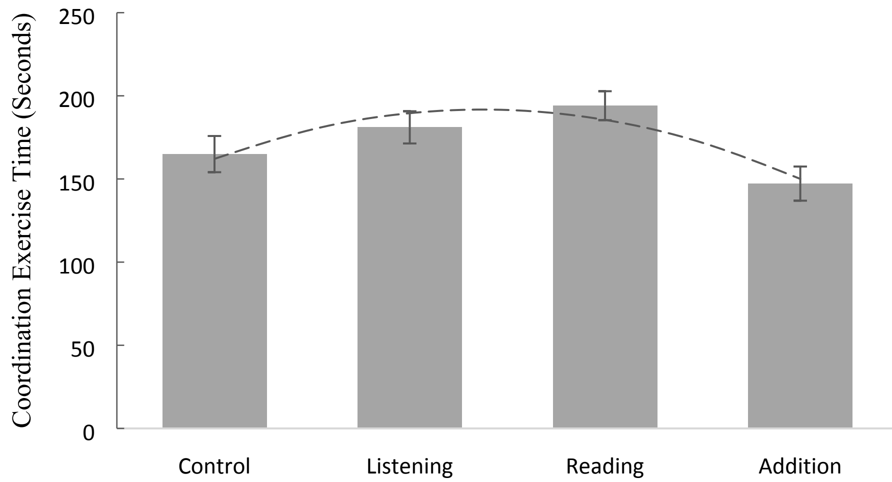
TIME SPENT ON TYPING TASK, EXPERIMENT 4



NOTE.—Error bars represent ± 1 SEM

FIGURE 3

PERSISTENCE IN COORDINATION EXERCISE ACROSS CONDITIONS, EXPERIMENT 5



NOTE.—Error bars represent ± 1 SEM, and the dotted line represents the 2nd degree polynomial trendline representing the predicted general inverted-U pattern.

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Web Appendix

Tangential Immersion:

Increasing Persistence in Boring Consumer Behaviors

Preregistrations, data, and material are available online at
https://osf.io/vy6cz/?view_only=f3dc6b16a38c4c5fb0fdfbf1d248f504.

CONTENTS

ADDITIONAL DISCUSSION ON ATTENTION AND DISTRACTION

Distractions can be either internal (e.g., mind wandering) or external (e.g., a noise in the room around you). Along with the overview in the main text, below we provide additional discussion of these distractions, and highlight previous relevant research.

Internal distractions can affect perceptions of a task, including being interpreted as a boredom signal as people may infer their lack of engagement as a sign they were not interested in the task. Critcher and Gilovich (2010) found that introducing a mind wandering manipulation during a focal task distracted participants from that task, leading them to rate it as more boring and increasing their displeasure with it. However, this effect was attenuated when participants were made aware that their mind wandering may have been caused by an experimental manipulation. Related work finds that priming people to mind wander can make passive waiting feel less (or more) boring depending on how people process their thoughts. Specifically, Wang, Hong, and Zhou (2017) demonstrate that when making affect-based judgments, priming people to have many task-unrelated thoughts while waiting made wait times feel shorter and less boring. On the other hand, when making cognitive-based judgments, many task-unrelated thoughts made wait-times feel longer and more boring.

External distractions can also affect task perceptions. Damrad-Frye and Laird (1989) had participants perform an activity that required attention with either no distraction, a very obvious distraction (loud TV), or a very subtle distraction (a TV playing at a barely noticeable volume). Participants who were in the subtle distraction condition reported the focal task as more boring than the other two conditions. That is, when participants were distracted and unable to engage with the task—but were not able to pinpoint the cause of their distraction—they attributed their inability to focus as a signal that the task was boring. Conversely, people who were distracted by the loud TV recognized it as the cause of their distraction and thus did not attribute it to their primary task. Intermittent interruptions can also distract attention and influence perceptions—Fisher (1998) found that participants who were *intermittently* interrupted while doing a simple task (e.g., confederates walking in and out of a room or having a brief phone call) reported lower levels of boredom than participants who were not interrupted. In other work, Zane, Smith, and Reczek (2020) demonstrate that when consumers are distracted, such as by background advertisements while multitasking, they sometimes use their level of distraction as a metacognitive cue that suggests interest in the distractor.

EXPERIMENT 1 PRETEST

Prior to running Experiment 1, we conducted a pretest to assess whether our stimuli were indeed considered more (vs. less) immersive.

Method

One hundred one Mturk workers completed a study in exchange for payment. Ninety five participants confirmed watching the video with sound and were thus included in the analysis (67% female, M_{age} = 35.37, SD_{age} = 11.21).

Participants watched a 4-minute clip of one of two videos: (1) Animal Planet: Clash Encounters of Bears and Wolves (more-immersive video); or, (2) a nature video with scenes of nature and pleasant music (less-immersive video). The two videos both contained scenes of nature and audio-visual components. However, the more-immersive video also contained a narrative component, which we predicted would increase its ability to capture and sustain attention.

After watching the video, participants answered a five-item immersion scale meant to measure how much the video captured and sustained their attention: "To what extent did this video capture your attention?"; "How engaging was this video?"; "How much was your mind wandering while watching the video (i.e., how much were you thinking about things unrelated to the video?)"; "How boring was this video?"; "For how long did it feel like you were watching the video?" on seven-point likert scales (1 = Not at all [Very short time] to 7 = Very [A lot/Very much/Very long time); the last three items were reverse coded. On the next page participants answered three questions measuring how much they enjoyed the video: How pleasant was this video?"; "How beautiful were the scenes in this video?"; "How much did you like this video?" on seven-point likert scales (1 = Not at all to 7 = Very [Very much]).

Results

Immersion Scale ($\alpha = .85$). As predicted, participants who watched the Animal Planet video rated it as significantly more immersive ($M_{more\text{-}immersive} = 4.94$) than participants who watched the nature video ($M_{less\text{-}immersive} = 4.36$; $b = .58$, $t(93) = 2.05$, $p = .043$).

Pleasant and Beautiful. The two items measuring how beautiful and pleasant they found the video were highly correlated and thus collapsed into a single measure ($r = .48$, $p < .001$). Participants rated Animal Planet as significantly less pleasant and beautiful ($M_{more\text{-}immersive} = 5.26$) than participants who watched the nature video ($M_{less\text{-}immersive} = 6.01$; $b = -.76$, $t(93) = -3.40$, $p <$ .001).

Liking. Participants liked the videos no differently ($M_{more\text{-}immersive} = 5.61$ vs. $M_{less\text{-}immersive} =$ 5.30; $b = .31$, $t(93) = 1.02$, $p = .311$).

Discussion

Results of the pretest indicate that participants liked the videos no differently, but thought the nature video was more beautiful and pleasant than Animal Planet. Most importantly, participants rated the Animal Planet video as significantly more immersive than the nature video.

EXPERIMENT 1

Experiment 1: Full Text of Experimental Instructions

Screenshot of instructions page 1:

In today's study, you are going to learn about a new form of toothbrushing called **dry brushing.**

Dry brushing involves brushing your teeth with a toothbrush, but with no water or toothpaste!

Recent research has shown many benefits of dry brushing. As a result, there is a movement in the dental community to **increase dry brushing!**

Screenshot of instructions page 2:

Dry brushing is particularly good for removing plaque. Plaque is the main cause of tooth decay and gum disease, so removing plaque from your teeth is extremely important!

Because dry brushing doesn't require anything but a toothbrush (no water, no toothpaste, no spitting), it can be done anywhere. Adding dry brushing to your daily routine is a great way to improve your oral health!

At checkout today, there will be brochures available with more information on the benefits of dry brushing.

Screenshot of instructions page 3:

To dry brush properly, you simply brush with a toothbrush (no toothpaste) until **all of your teeth feel smooth**.

We hope that once you try dry brushing, you will see how clean your teeth feel and will incorporate it into your oral hygiene routine!

Screenshot of instructions page 4:

On the next page, you can try dry brushing for yourself.
While you are dry brushing, we will give you a video to watch.

Dentists recommend that you dry brush for at least 8-10 minutes every day. The longer you brush, the cleaner your teeth will be!

In today's study, **you can dry brush for as long as you want.**

Screenshot of instructions page 5:

Please put on your headphones and unwrap the toothbrush on your desk.
When you are ready, press play on the video and begin brushing your teeth.
Because these brushes are brand new, they may have a slight taste at first, but this will go away after about 5 seconds.

You may brush for as long as you wish, but remember that the longer you brush the better!
When you are done brushing click next.

Experiment 1: Recruitment and Attrition

Four hundred forty nine undergraduates participated in exchange for course credit. Twenty nine participants failed the comprehension check asking them for how long they were asked to try dry brushing (I was told to dry brush for as long as I wished; I was told to dry brush for the entire duration of the video; I was told to dry brush for a minimum of 2 minutes; I don't know) and were thus excluded, consistent with the preregistered exclusion criteria. No other participants were excluded. Therefore, four hundred twenty participants were included in the analysis (60% female, M_{age} = 21.03, SD_{age} = 2.36).

Experiment 1: Additional Measures Not Reported in Main Text

Persistence. As described in the main text, the primary dependent variable in this experiment is persistence in dry brushing among participants in the more-immersive condition (vs. less-immersive condition; see table 1).

TABLE 1

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 1

	Untransformed Time (1)	Logged Time (2)	Untransformed Time + Covariates (3)	Logged Time + Covariates (4)
More-immersive	39.65*** (10.71)	.17* (.08)	39.58*** (10.72)	.17* (.08)
Ever heard of dry brushing			-13.19 (13.58)	-.07 (.10)
How often brush teeth			-8.92 (8.75)	-.06 (.07)
Constant	132.39*** (7.54)	4.68*** (.06)	190.95*** (40.70)	5.04*** (.31)
# Observations	420	420	420	420
R^2	.03	.01	.04	.02

NOTE.—Standard errors in parentheses. Levels of significance: *$p < .05$, **$p < .01$, ***$p < .001$.

The majority of participants (84.52%) reported usually brushing their teeth at least twice a day and never having heard of dry brushing (80.48%). Most participants (96.67%) reported speaking English well or very well.

EXPERIMENT 1S: TANGENTIAL IMMERSION INCREASES PERSISTENCE BEYOND MONITORING

Experiment 1s generalizes the effect of tangential immersion to different focal (a real-effort typing task) and tangential (listening to an audiobook) tasks. Additionally, whereas in experiment 1 both conditions involved a tangential task, in experiment 1s, we add a pure control condition in which participants only perform the focal task. Further, we compare tangential immersion to a condition in which participants are given a common monitoring tool—a timer—to help them track how long they do the task. In doing so, we test whether tangential immersion increases persistence beyond monitoring one's behavior. Finally, we include a condition in which participants only do the tangential task (i.e., audiobook). In experiment 1 participants were told to move on after quitting the focal task, thus it is possible their persistence was impacted by a desire to continue watching the video and thinking they must continue the focal task in order to do so (as opposed to persistence resulting from a better attentional match). We predict that tangentially immersed participants will persist in the typing task longer than participants in the control and monitoring conditions, and at least as long as those who only listen to the audiobook.

Method

Four hundred seven Amazon Mechanical Turk workers completed a study in exchange for payment. One hundred thirteen participants failed a comprehension check and were thus excluded, consistent with the preregistered exclusion criteria. A one-way ANOVA revealed that attrition did not vary across conditions ($F(3, 403) = .43$, $p = .733$). Thus, two hundred ninety four participants were included in the analysis (45% female, $M_{age} = 36.04$, $SD_{age} = 10.83$).

Participants began by reading: "In this study, we are interested in learning what makes people persist in activities for longer." On the next page, they were assigned to one of four conditions: (1) a low-attention typing task (control); (2) a low-attention typing task with a timer (monitoring); (3) a low-attention typing task while concurrently listening to an immersive audiobook (tangential immersion); (4) listening to an immersive audiobook (audio-only). In the three conditions that included the low-attention typing task, participants read “Life is filled with activities that people should do for longer (e.g., brushing their teeth, exercising, doing chores, etc.). In this study, you will do a task that represents this type of daily activity.” They then learned the typing task they would do is to type the letters “zm” repeatedly for as long as they could. Participants in the tangential immersion condition further read, “while you are typing, you will also listen to an excerpt from an audiobook.” Participants in the tangential immersion and audio-only conditions listened to an excerpt from the audiobook *Divergent*. Participants in the audio-only condition were informed they could listen as long as they chose (but were not given a goal of persistence, as in the other three conditions). In all four conditions participants were reassured that they would receive the same payment no matter how long they did the task.

On the next page, participants performed their task. In the control condition, participants were simply told to type “zm” for as long as they could. In the monitoring condition, participants saw a media player with a 9:53 minute play time and were told to press play on the timer and then type “zm” for as long as they could. These participants also read “the timer will help you keep track of how long you do the task.” Participants in the tangential immersion condition saw a media player with a 9:53 minute play time and were told to press play on the audio and then type “zm” for as long as they could. Finally, participants in the audio-only condition saw a media player with a 9:53 minute playtime and were told to press play and listen for as long as they chose. After performing their task, participants responded to a comprehension check asking them for how long they were asked to do the typing task [listen to the audio] (for as long as I could [for as long as I chose], for about 15 minutes, for about 10 minutes, not sure), and reported their gender identity and age.

Results

Persistence. Relative to control (M = 71 seconds), participants persisted longer in the typing task in both the monitoring (M = 116 seconds; b = 45.37, t(290) = 2.06, p = .040; logged: b = .59, t(290) = 3.31, p = .001) and tangential immersion conditions (M = 189 seconds; b = 118.02, t(290) = 5.35, p < .001; logged: b = .94, t(290) = 5.20, p < .001; see table 2). Further, as predicted, tangentially immersed participants persisted longer in the typing task than those in the monitoring condition (b = 72.65, t(290) = 3.23, p = .001; logged: b = .34, t(290) = 1.87, p = .063). Finally, participants in the audio-only condition listened to the audio for significantly less time (M = 111 seconds) than tangentially immersed participants (b = -78.44, t(290) = -3.45, p < .001; logged: b = -.73, t(290) = -3.96, p < .001).

TABLE 2

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 1S

	Untransformed Time (1)	Logged Time (2)
Condition: Monitoring	45.37* (21.98)	.59** (.18)
Condition: Audio Only	39.57^{+} (22.23)	.20 (.18)
Condition: Tangential Immersion	118.02*** (22.06)	.94*** (.18)
Constant	71.10*** (15.23)	3.78*** (.12)
# Observations	294	294
R^2	.09	.10

NOTE.—Standard errors in parentheses. Levels of significance: *p < .05, **p < .01, ***p < .001.

Persistence (Characters Typed). Number of characters typed was assessed as a secondary measure of persistence. To account for unequal variances across conditions, we compared the average number of characters typed using independent t-tests with equal variances not assumed. Compared to control ($M = 319$), participants typed marginally more characters in the monitoring ($M = 420$) and significantly more in the tangential immersion conditions ($M = 887$; t(119.6 and 74.86) = 1.74 and 3.07, $p = .085$ and .003). Moreover, tangentially immersed participants typed significantly more than those in the monitoring condition ($t(81.49) = 2.47$, $p = .016$).

Error Rate. To test whether tangential immersion impacted performance, we calculated a rate of typing errors using an algorithm in R designed to identify errors in the text sequence.[1] Specifically, we counted the number of "zm" combinations typed and subtracted it from the total number of pairs in the text sequence (i.e., we counted the number of erroneous pairs and subtracted that from the total number of pairs typed to calculate the proportion of pairs which contained an error). Error rate was not significantly different in the tangential immersion condition ($M = 3.67$) compared to the control ($M = 1.40$; $b = 2.28$, $t(218) = 1.49$, $p = .137$) or monitoring conditions ($M = 3.79$; $b = -.12$, $t(218) = -.08$, $p = .938$).

Discussion

Experiment 1s demonstrates that participants given a timer to track their progress persist longer in a low-attention behavior relative to control, but that tangential immersion increases persistence beyond monitoring. Further, in experiment 1s we assessed errors in the focal behavior and found that tangential immersion did not increase (or decrease) typing errors. These findings support our theory that tangential immersion occupies attention in *excess* of that

[1] For the algorithm to run properly, participants who chose not to type any characters had to be excluded (this excludes three participants total).

demanded by the focal task, thus neither decreasing nor increasing attention paid to it.

Tangentially immersed participants persisted in their tasks longer than participants who only listened to the audiobook (without doing the focal task). This result suggests that persistence cannot be explained by tangentially immersed participants believing that to continue listening they must also continue typing (i.e., a required bundling of the two behaviors; Kirgios et al. 2020; Milkman, Minson, and Volpp 2014). Notably, whereas in the three typing conditions participants were told to persist as long as they could, in the audio-only condition participants were merely told to listen as long as they chose. For this reason, we cannot draw clear conclusions about whether typing while listening affected persistence in the listening task (as opposed to being given a persistence goal; Shaddy and Fishbach 2018). Another possibility is that, because the audio condition did not occupy complete attention (if so, it could not be combined with the low-attention task), participants grew bored more quickly than when the total task demands better matched available resources. This pattern of results (tangential immersion vs. audio-only) is also consistent with those demonstrated by Chinchanachokchai, Duff, and Faber (2019), who examined how adding a low-load task to a focal task that requires attention can increase the processing of the focal task. While the current research focuses on the audiobook occupying attention *in excess of the typing task*, Chinchanachokchai et al's (2019) findings would suggest that the typing task may actually help *increase attention paid to the audiobook* (relative to only listening to the audiobook). Future research could further investigate whether adding a low-attention task to a task that requires attention also increases persistence in the attention-demanding task, in the same way it increases processing of the task.

EXPERIMENT 1S: FULL TEXT INSTRUCTIONS

Screenshot of introduction:

Welcome!

In this study, we are interested in learning what makes people persist in activities for longer.

We appreciate your time and attention.

Thank you!

On the next page, participants read: “Life is filled with activities that people should do for longer (e.g., brushing their teeth, exercising, doing chores, etc.). In this study, you will do a task that represents this type of daily activity.” Participants all then read instructions for their assigned task (screenshots below).

Screenshot of instructions for participants in the control, monitoring, and tangential immersion conditions:

The task that you will be doing is typing the letters "zm" as many times as you can.

See the picture below for an example of this typing task:

zmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzm
zmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzm

Screenshot of instructions for participants in the audio condition:

In this study, you will listen to an excerpt from an audiobook.
You may listen for as long as you choose.

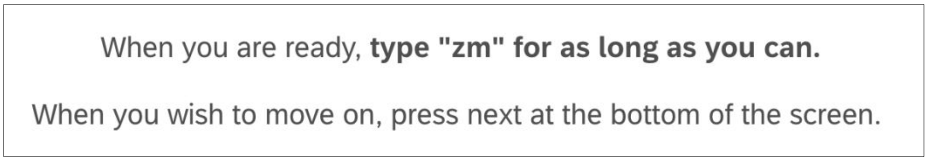
You will receive the same payment no matter how long you listen.

On the next page, participants in the typing conditions read: “We want to see for how long you can persist in this typing task. Please do your best to be as accurate as possible and type the letters in the proper order without using shortcuts (key strokes will be tracked). You will receive the same credit no matter how long you do this task.”

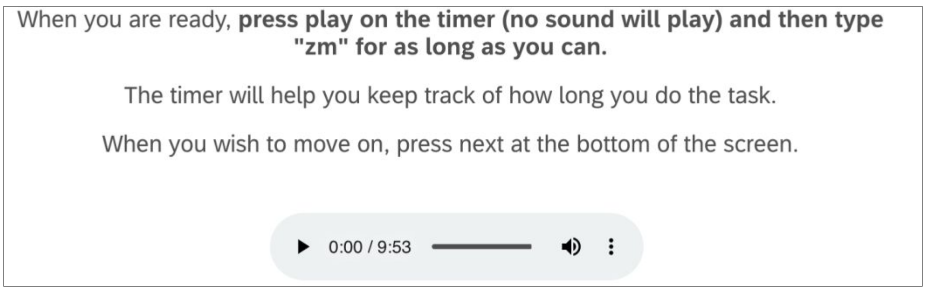
Participants in the tangential immersion condition further read: “**While you are typing, you will also listen to an excerpt from an audiobook. Please put your headphones on now.**”

On the next page, participants began the task (screen shots of each condition below).

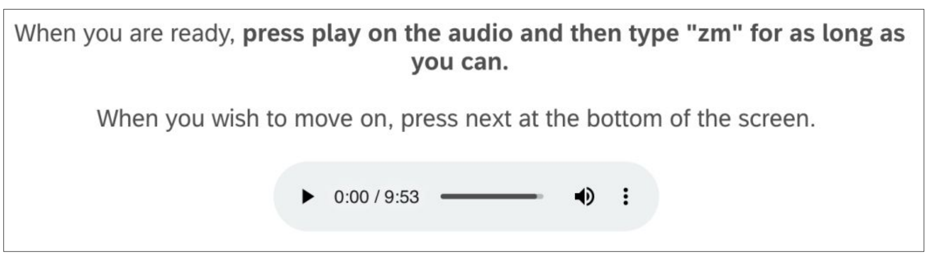
Screenshot of instructions for the control condition:



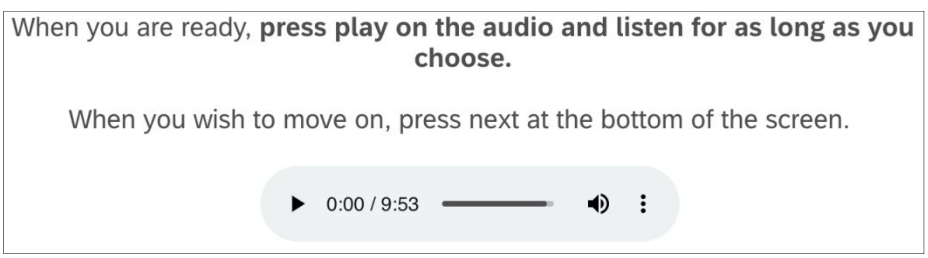
Screenshot of instructions for the monitoring condition:



Screenshot of instructions for the tangential immersion condition:



Screenshot of instructions for the audio condition:



EXPERIMENT 2 PRETEST

We conducted a pretest to assess whether our tangential task stimuli were considered more (vs. less) immersive and more (vs. less) enjoyable.

Method

Three hundred eighty eight undergraduates participated in exchange for course credit. Twenty participants reported not doing the tangential task (i.e., not playing the media) and were thus excluded, consistent with the preregistered exclusion criteria. Attrition did not differ across conditions, $F(2, 385) = .01$, $p = .993$. Thus, three hundred sixty eight participants were included in the analysis (62% female).

Participants were randomly assigned to watch a two-minute media file: a dot scrolling across the computer screen (control); a short story scrolling across the computer screen (reading); or, a pleasant picture accompanied by piano music (pleasant). Prior to doing the tangential task, participants in the reading condition read that after they finished reading, they would be asked a few questions about the content (this mirrors the instructions in the full experiment, which was designed to encourage participants to attend to the tangential task). These questions were designed to encourage attention to the tangential task and are thus not discussed further.

After doing the tangential task, participants answered a three-item scale designed to measure how much the video captured and sustained their attention: "To what extent did this task capture your attention?"; "How engaging was this task?"; "How much was your mind wandering while doing this task (i.e., how much were you thinking about things unrelated to the task?)" on seven-point likert scales (1 = Not at all to 7 = Very [A lot/Very much]); the last item was reverse coded. On the next page, participants answered two questions measuring how much they enjoyed the task: "How pleasant was this task?"; "How much did you like this task?" on seven-point likert scales (1 = Not at all to 7 = Very [Very much]). Finally, participants were asked "How important was this task?" (1 = Not at all to 7 = Very much). This final item was included to test whether telling participants in the reading condition that they would be asked about the content of the tangential task made it seem more important than the other two tasks. Finally, participants indicated whether or not they did the task and reported their gender identity.

Results

Immersion Scale ($\alpha = .83$). As predicted, participants who did the reading task rated it as significantly more immersive ($M_{reading} = 3.88$) than participants who did the control ($M_{\text{control}} = 1.95$) and pleasant tasks ($M_{pleasant} = 3.19$; $bs = 1.93$ and $.68$, $ts(365) = 10.22$ and 3.72, $ps < .001$). Participants who did the pleasant task also rated it as more immersive than control ($b = 1.24$, $t(365) = 6.50$, $p < .001$).

Pleasant and likable. The two items measuring how pleasant and likable the task was were highly correlated and thus collapsed into a single measure of enjoyability, consistent with our preregistration ($r = .89$, $p < .001$). Participants rated the pleasant task as significantly more enjoyable ($M_{pleasant} = 4.69$) than participants who did the control ($M_{control} = 1.88$) and reading tasks ($M_{reading} = 3.00$; $bs = 2.81$ and 1.69, $ts(365) = 14.06$ and 8.76, $ps < .001$). Participants who did the reading task also rated it as more enjoyable than control ($b = 1.12$, $t(365) = 5.69$, $p < .001$). Results are consistent when testing pleasantness and likability as separate measures.

Importance. The reading ($M_{reading} = 2.50$) and pleasant ($M_{pleasant} = 2.62$) tasks were both perceived as more important than the control task ($M_{control} = 1.85$; $bs = .65$ and $.77$, $ts(365) = 3.33$ and 3.92, $ps < .001$), but were not significantly different from each other ($b = .12$, $t(365) = .66$, $p = .511$).

Discussion

Results of the pretest indicate that, as designed, participants perceived the pleasant task as the most enjoyable of the three tasks, whereas they perceived the reading task as the most immersive. The pleasant task was rated as less immersive than the reading task, but more immersive than control. While we did not expect this difference to be significant, it likely reflects that listening to pleasant music does indeed capture more attention than simply watching a scrolling dot—a task that is neither pleasant nor engaging.

We also assessed whether providing participants with an additional prompt to encourage attention in the reading task made them think it was more important than the other two tasks. We found that participants in the control condition perceived the task as less important than both participants in the reading and pleasant conditions. Importantly, however, those in the reading condition did not perceive the task as any more important than the pleasant condition, suggesting that perceptions of importance were not driven by this difference in instructions.

EXPERIMENT 2

Experiment 2: Full Text Instructions

Screenshot of instructions for participants in the control condition:

On the next page, you will see an image of a scrolling dot.

For multi-tasking purposes, you will do a coordination exercise while watching the dot. While you are watching to dot (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm out straight for the entire time that you are watching the scrolling dot. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop watching the scrolling dot and move on to the next page.

Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

Screenshot of instructions for participants in the reading condition:

On the next page, you will read a short story.

For multi-tasking purposes, you will do a coordination exercise while reading. While you are reading the story (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm straight out for the entire time that you are reading. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop reading and move on to the next page.

Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

After you finish reading, you will be asked to answer a few questions about the content of what you read.

Screenshot of instructions for participants in the pleasant condition:

On the next page, you will listen to piano music.

For multi-tasking purposes, you will do a coordination exercise while listening. While you are listening to the music (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm out straight for the entire time that you are listening to the music. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop listening and move on to the next page.

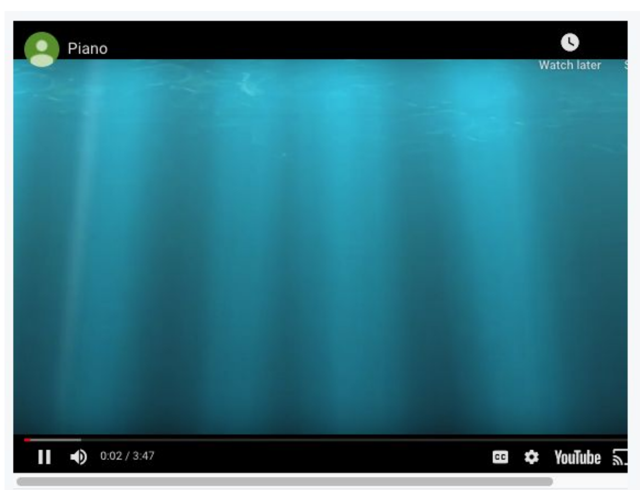
Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

On the next page, participants held out their arm while doing the tangential task (screen shots below of the video each participant watched).

Screenshot of the control condition tangential task:

Screenshot of the reading condition tangential task:

Screenshot of the pleasant condition tangential task (piano music played):



Experiment 2: Additional Method Details Not Reported in Main Text

After the persistence task, participants responded to manipulation checks and items measuring task perceptions: "How enjoyable was this experience"; "While holding out your arm, how immersed in the other task were you?"; "While holding out your arm, how focused on the other task were you?"; "How painful was it to hold out your arm?"; "While doing the task, to what extent did you forget that you were holding out your arm?" (1 = Not at all to 7 = Very [or Completely]); and, "How many dollars would you need to be paid to hold out your arm for 5 minutes? (sliding scale from $0 to $25). The first three questions were designed to be manipulation checks. The items measuring pain, to what extent they forgot they were holding out their arm, and how much they would need to be paid to do the task for five minutes were included to test whether tangential immersion distracted participants from the physical sensations of the task.

Experiment 2: Robustness Checks and Additional Measures Not Reported in Main Text

Persistence. As described in the main text, the primary dependent variable in this experiment is persistence in the coordination exercise among participants in the reading and pleasant conditions relative to control (see table 3).

TABLE 3

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 2

	Untransformed Time (1)	Logged Time (2)
Condition: Pleasant	9.17 (8.13)	.06 (.07)
Condition: Read	17.17* (8.22)	.17* (.08)
Constant	155.63*** (5.75)	4.89*** (.05)
# Observations	411	411

R^2	.01	.01

NOTE.—Standard errors in parentheses. Levels of significance: *$p < .05$, **$p < .01$, ***$p < .001$.

Additional Measures. Prior to running each participant, the RA recorded which breakout room they were in, their own (the RA's) gender, and their own (the RA's) initials. The measure of persistence remains significantly greater in the reading condition (vs. control condition), when controlling for each of these items (*ps* < .039).

Robustness Checks. As robustness checks, participants indicated the size of their phone (large screen/small screen), their handedness (right, left, ambidextrous), and which arm they held out. The majority of participants reported being right-handed (91%), holding out their right arm (42%), and having a large-screen phone (68%). The persistence measure remains significantly different in the reading condition (vs. control) when controlling for the size of their phone (p = .034) and their handedness (p = .035), and is marginal when controlling for which arm they held out (p = .070).

EXPERIMENT 3 PRETEST

We conducted a pretest to assess whether being tangentially immersed while typing occupied excess attention.

Method

Two hundred participants from Amazon Mechanical Turk completed a study in exchange for payment. Five participants reported not following instructions (i.e., either reported not listening to something in the tangential immersion condition or listening to something in the control condition) and were excluded. Thus, one hundred ninety five participants were included in the analysis (45% female, M_{age} = 36.52, SD_{age} = 10.77).

Participants read similar instructions as the main experiment 3 study. Participants were given a general goal to persist; however, unlike in the previous studies they all did the task for a fixed amount of time (two minutes). Aligned with this design, participants read: "We want to see for how long you can persist in this typing task, but ask that you do it for at least three minutes." (The instructions said three minutes to be consistent with our stimuli for the main study, but in the pretest they all did the task for only two minutes). This instruction was included so as not to surprise participants when they were unable to immediately advance in the study as they did not know ahead of time that they would be performing the task for a fixed amount of time. Participants were randomly assigned to perform the low-attention typing task (typing "zm") either while: (1) listening to nothing (control[2]); or, (2) listening to an immersive audio clip (tangential immersion). In both conditions, participants saw a media player with a 9:53 minute play time, and were instructed to press play and begin typing for as long as they could.

After doing the typing task for two minutes, participants answered a three-item scale designed to measure their *excess* attention while doing the typing task (α = .53): "My attention was fully occupied by the task(s) I was doing" (reverse coded); "My attention was partially somewhere else (e.g., my mind was wandering, I found myself looking around the room, etc.)"; "I could have easily done an additional task at the same time without feeling overwhelmed" (1 = Strongly disagree, 7 = Strongly agree). As noted in the main text, the reliability of this scale increased (α = .84) without the inclusion of the third item. Thus, while we report the results of both the 2-item and 3-item scale in the main text, based on this analysis we preregistered and used only the first two items as the excess attention scale in the main study. Participants

[2] Here and in the main study, the control participants were given an extra line of instruction at the beginning that was not included in experiments 1s or 5: "While you are typing, please do NOT listen to anything else (e.g., no music, tv, audiobooks, etc)." This additional instruction was included to further strengthen the manipulation and reduce the likelihood of exclusions.

indicated whether or not they did the task as instructed: "While doing the typing task, did you listen to the audiobook? Please be honest, you will receive the same payment no matter your answer" (tangential immersion condition; Yes, I listened to the audiobook/ No, I did not listen to the audiobook/ Other), "While doing the typing task, did you listen to anything else (e.g., music, audiobook, tv)? Please be honest, you will receive the same payment no matter your answer (control; No, I did NOT listen to anything while doing the typing task/ Yes, I was listening to something while doing the typing task/ Other). Lastly, they reported their gender identity and age.

EXPERIMENT 3

Experiment 3: Full Text Instructions

Screenshot of introduction:

Welcome!

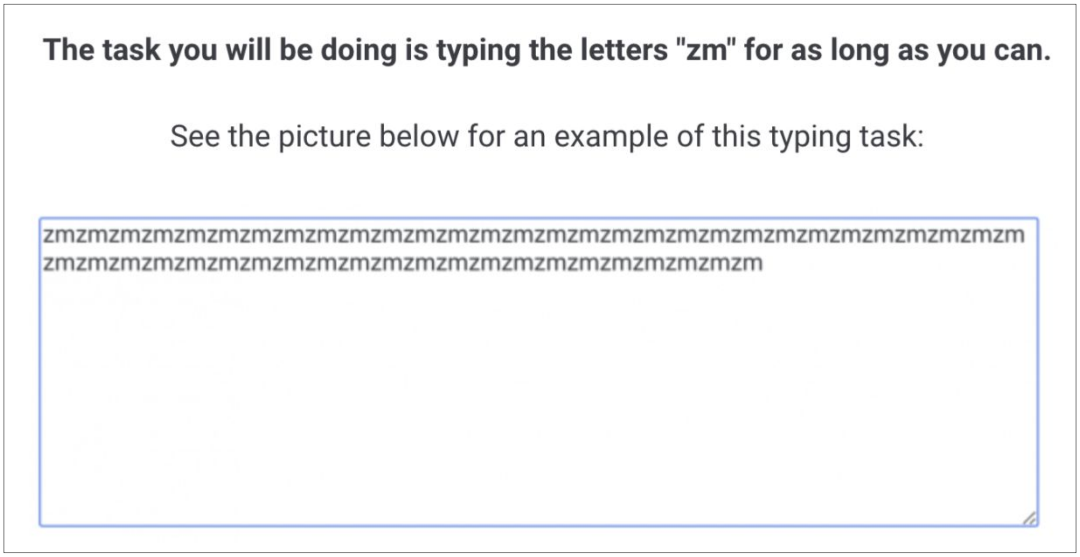
In this study, we are interested in learning what makes people persist in activities for longer.

We appreciate your time and attention.

Thank you!

On the next page, participants read: "Life is filled with activities that people should do for longer (e.g., brushing their teeth, exercising, doing chores, etc.). In this study, you will do a task that represents this type of daily activity." Participants then read instructions for their assigned task (screenshot below).

Screenshot of instructions:

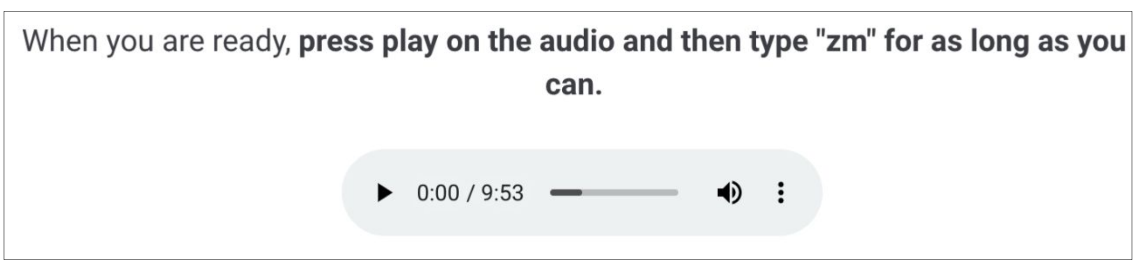


Participants then read: "We want to see for how long you can persist in this typing task, but ask that you do it for at least three minutes. Please do your best to be as accurate as possible and type the letters in the proper order without using shortcuts (key strokes will be tracked). You will receive the same credit no matter how long you do this task."

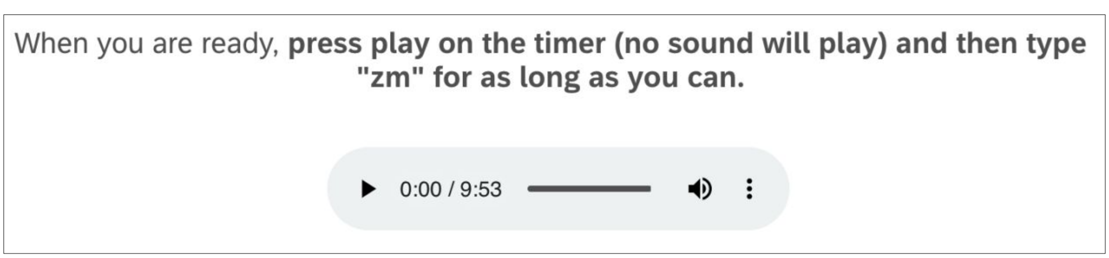
Participants in the immersed conditions further read: "**While you are typing, you will also listen to an excerpt from an audiobook.** Please make sure your volume is on and you are ready to listen." Participants in the control condition further read: "**While you are typing, please do NOT listen to anything else (e.g., no music, tv, audiobooks, etc.).**"

On the next page, participants began the task (screen shots of each condition below).

Screenshot of instructions for the tangential immersion condition:



Screenshot of instructions for the control condition:



Experiment 3: Recruitment and Attention Check

Four hundred Amazon Mechanical Turk workers completed a study in exchange for payment. At the end of the study, participants were asked whether they followed instructions using the items described in the pretest above. A total of seven participants indicated not following instructions and were thus excluded. Thus, three hundred ninety three participants were included in the analysis (51% female, M_{age} = 40.26, SD_{age} = 11.99).

EXPERIMENT 4

Experiment 4: Full Text Instructions

Screenshot of introduction:


Welcome!

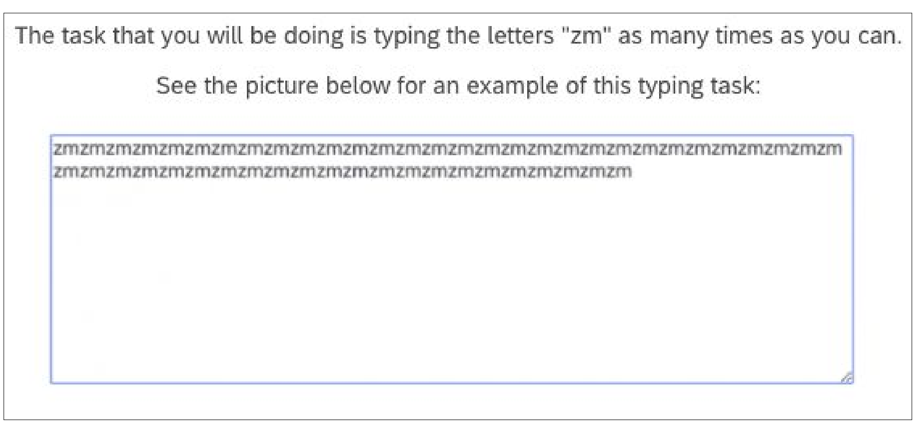
Life is filled with lots of daily activities that people should do for longer (e.g., brushing their teeth, exercising, doing chores, etc.). In this study, we are interested in learning how different interventions can make people persevere in these activities for longer!

We appreciate your time and attention!

Thank you!

On the next page, participants read: “As mentioned, life is filled with activities that people should do for longer. In this study, you will do a task that represents this type of daily activity.” Participants then read instructions for their assigned task (screenshots below).

Screenshot of instructions for the low-attention focal task:


The task that you will be doing is typing the letters "zm" as many times as you can.

See the picture below for an example of this typing task:

zmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzm
zmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzmzm

Screenshot of instructions for medium-attention focal task:

The task that you will be doing is typing the alphabet forward (A to Z) then backward (Z to A) as many times as you can.

See the picture below for an example of this typing task:

abcdefghijklmnopqurstuvwxyzzyxwvutsrqponmlkjihgfedcbaabcdefghijklmnopqurstuvwxyzzyx
wvutsrqponmlkjihgfedcba

Screenshot of instructions for high-attention focal task:

The task that you will be doing is typing words that begin with each letter of the alphabet as many times as you can. When you get to "Z," start over again at "A" without repeating any of the same words!

See the picture below for an example of this typing task:

Apple, Banana, Candy, Dolphin, Elephant, Frog, Grandma, House, Igloo, Jackfruit, Kangaroo, Llama, Monkey, Newspaper

Participants all then read: "We want to see for how long you can persevere in this typing task. Please do your best to be as accurate as possible and type the letters in the proper order without using shortcuts (key strokes will be tracked). You will receive the same credit no matter how long you do this task."

Participants in the immersed conditions further read: "**<u>While you are typing, you will also listen to an excerpt from an audiobook. Please put your headphones on now.</u>**"

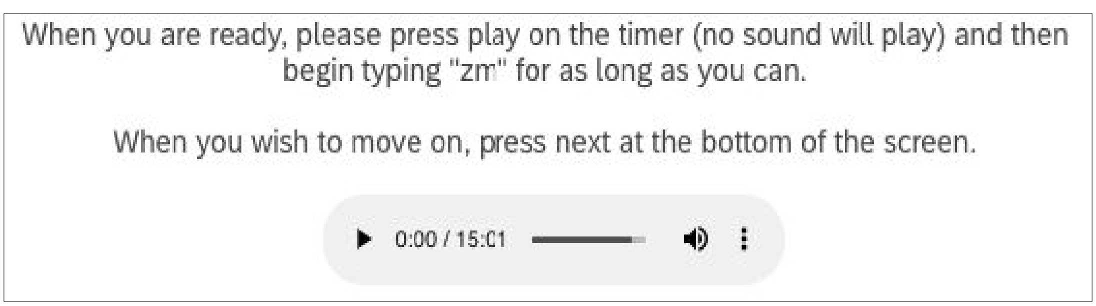
On the next page, participants began the task (screen shots of each condition below).

Screenshot of instructions for the low-attention tangential immersion condition:

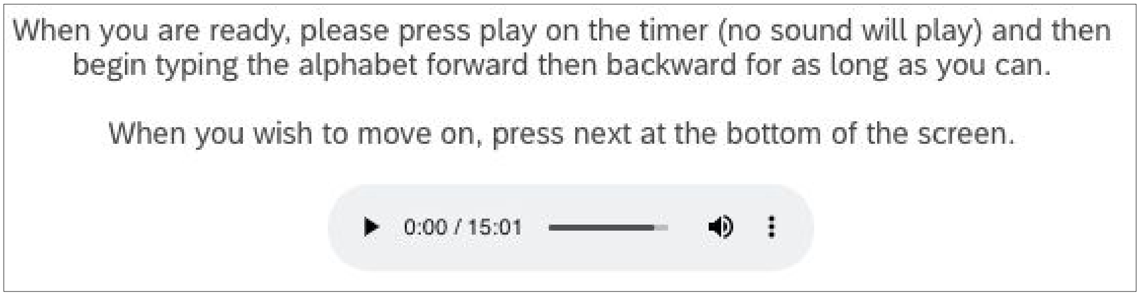
Screenshot of instructions for the medium-attention tangential immersion condition:

Screenshot of instructions for the high-attention tangential immersion condition:

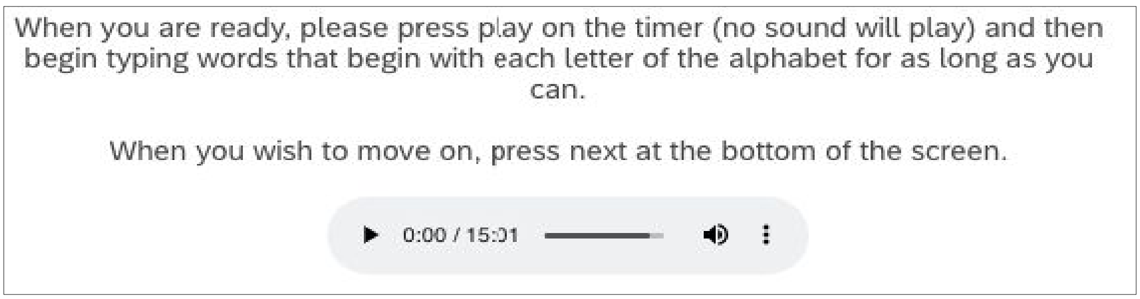
Screenshot of instructions for the low-attention control condition:



Screenshot of instructions for the medium-attention control condition:



Screenshot of instructions for the high-attention control condition:



Experiment 4: Recruitment and Attrition

One thousand ninety two undergraduates participated in exchange for course credit. Four hundred six participants failed the comprehension check asking them for how long they were asked to do the typing task (for as long as I could, for about 15 minutes, for about 6 minutes, not sure) and were excluded, consistent with the preregistered exclusion criteria. A one-way ANOVA revealed that attrition varied significantly across conditions ($F(5, 1086) = 3.03$, p = .010). A post-hoc Tukey test revealed that attrition differed significantly between the low-attention tangential immersion condition and the high-attention control condition (p = .011); however, no other comparisons were significant (ps >.10). Therefore, six hundred eighty six participants were included in the analysis (54% female, $M_{age} = 20.81$, $SD_{age} = 2.12$).[3]

Experiment 4: Additional Method Details Not Reported in Main Text

After the typing task, participants responded to several items measuring their perceptions

[3] One person wrote in an age of 40,888 and thus their age was removed when calculating the average age.

of the task: a single item rating the typing task on a sliding scale from 1 = Boring to 10 = Fun; as well as a 2-item task-enjoyability scale: "How fun was the typing task?"; "To what extent did you enjoy the typing task?"; and, a 3-item boredom scale: "To what extent did it feel like time was dragging?"; "To what extent did you wish you were doing something more exciting?"; and "To what extent was your mind wandering?" on likert scales (1 = Not at all to 7 = Very [or A lot]).

Experiment 4: Robustness Checks and Analyses Not Reported in Main Text

Persistence. As described in the main text, the primary dependent variable in this experiment is persistence in the typing task, which we first examined between the low- versus high(er) attention tasks using the complete set of orthogonal contrast codes model (see table 4).

TABLE 4

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 4

	Untransformed Time (1)	Logged Time (2)
Low vs. High(er)	-31.89*** (4.62)	-.21*** (.02)
Med. vs. High	42.33*** (8.27)	.27*** (.04)
Tangential Immersion	7.77 (6.64)	.04 (.03)
Low vs. High(er)*Immersed	8.56+ (4.62)	.06* (.02)
Med. vs. High*Immersed	2.13 (8.27)	.009 (.04)
Constant	178.35*** (6.64)	4.76*** (.03)
# Observations	686	686
R^2	.10	.15

NOTE.—Standard errors in parentheses. Levels of significance: +p < .10 *p < .05, **p < .01, ***p < .001. Low versus high(er) contrast coded (low-attention = 2 vs. medium-attention = -1 vs. high-attention = -1), medium versus high contrast coded (low-attention = 0, medium-attention = -1, high-attention = 1), immersion contrast coded (control = -1 vs. tangential immersion = 1).

As described in the main text, we extracted simple effects for typing time using a dummy-coded model. To do this, we dummy coded the focal task (low-attention: low- = 1 vs. medium- = 0 vs. high-attention = 0; medium-attention: low- = 0 vs. medium- = 1 vs. high- = 0; and, high-attention: low- = 0 vs. medium- = 0 vs. high-attention = 1), as well as tangential immersion (control = 0 vs. tangential immersion = 1). We then regressed our dependent variable on dummy coded medium-attention, dummy coded high-attention, immersion, the interaction between medium-attention and immersion, and the interaction between high-attention and immersion, as follows:

Y = b0 + b1*MedDum + b2*HighDum + b3*Immersion + b4*MedDum*Immersion + b5*HighDum*Immersion

We ran three versions of the model and included only two of the dummy coded variables at any one time to extract different sets of simple effects. Using the dummy coded model, we also report below the interaction effects between the three tasks and tangential immersion. There was an interaction between tangential immersion and the low- (vs. medium-attention) task (b = -55.63, t(680) = -1.74, p = .082; logged: b = -.35, t(680) = -2.13, p = .033), as well as for the low (vs. high-attention) task (b = -47.10, t(680) = -1.45, p = .148; logged : b = -.31, t(680) = -1.88, p = .061; see table 2). In contrast, there was no interaction between tangential immersion and the medium- (vs. high-attention) task (ps > .796; see table 5).

TABLE 5

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 4

	Untransformed Time (1)	Logged Time (2)

Medium	81.14*** (22.68)	.55*** (.12)
High	161.54*** (23.50)	1.07*** (.12)
Tangential Immersion	49.79* (22.22)	.30** (.11)
Medium *Immersed	-55.63+ (31.98)	-.35* (.16)
High*Immersed	-47.10 (32.53)	-.31+ (.17)
Constant	89.68*** (16.31)	4.18*** (.08)
# Observations	686	686
R^2	.10	.15

NOTE.—Standard errors in parentheses. Levels of significance: $+p < .10$ $*p < .05$, $**p < .01$, $***p < .001$. Task dummy coded ([1/0] low-attention vs. [1/0] medium-attention vs. [1/0] high-attention), immersion dummy coded (control = 0 vs. tangential immersion = 1).

Persistence (Characters Typed). Number of characters typed was assessed as a secondary measure of persistence. To examine the interaction between task and tangential immersion, we ran the complete orthogonal contrast codes model above with number of characters typed as the dependent variable. Results revealed a significant interaction between tangential immersion and the low- (M = 617) versus high(er)-attention tasks (M = 301; b = 51.07, t(680) = 2.05, p = .041),[4] and no interaction between the medium- (M = 312) and high-attention tasks (M = 290; p = .353).

We used the dummy coded models to extract simple effects. Analyses revealed that within the low-attention conditions, tangentially immersed participants (M = 735) typed significantly more characters than control participants (M = 481; b = 254.15, t(680) = 2.12, p = .034). However, there was no effect of tangential immersion on number of characters typed for

[4] One participant in the medium-attention control condition typed 19,214 characters and indicated in the comments that they copied and pasted the text. When excluding this participant, the interaction between low vs. high(er)-attention tasks remains significant (p = .016), and the interaction between the medium- and high-attention tasks remains nonsignificant (p = .937).

participants in the medium- ($M_{immersion}$ = 240 vs. $M_{control}$ = 375)[5] or high-attention conditions ($M_{immersion}$ = 305 vs. $M_{control}$ = 274; *b*s = -135.24 and 30.74; *t*s(680) = -1.09 and .24, *p*s = .276 and .811).

Additional Measures. Participants also reported whether they have ever read or listened to *The Hobbit* (Yes, No, Not sure) and how well they speak English (Very well, Well, Not well, Not at all). The majority of participants (67.5%) had neither read nor listened to *The Hobbit*, about one-third of participants had (29.0%), and a few (3.5%) were unsure. In response to the English-proficiency measure, 97.7% of participants indicated speaking English well or very well.

EXPERIMENT 4S (CONCEPTUAL REPLICATION)

Experiment 4S sought to conceptually replicate experiment 4 (in the main text) with an online population and a different tangential task. In this experiment, participants performed either a low-attention or high-attention task. We again predict that tangential immersion will increase persistence in a low-attention task but not in a high-attention task.

Method

Eight hundred Amazon Mechanical Turk workers completed a study in exchange for payment. Three entries were determined to be computer bots and were thus removed. An additional 221 participants failed the comprehension check and were thus excluded, consistent with the preregistered exclusion criteria. Attrition did not differ across conditions, $F(3, 793) = 1.45$, $p = .228$. Thus, five hundred seventy six participants were included in the analysis (46% female, M_{age} = 35.93, SD_{age} = 10.17).

Participants read the same introduction and instructions as in experiment 5, but in a 2

[5] When excluding the participant who admitted copying and pasting, the mean number of characters typed in this condition is 218 (vs. 375). Without this participant, the simple effect of tangential immersion on the medium-attention task remains nonsignificant (b = 21.75, t(679) = .28, p = .782).

(tangential immersion vs. control) x 2 (low-attention vs. high-attention) design. Participants were assigned to either do a typing task that required very little attention (type "zm" repeatedly) or a typing task that required a higher level of attention (typing the alphabet forward then backward repeatedly; these tasks were the same at the low-attention and medium-attention tasks in experiment 5). Participants then read: "We want to see for how long you can persevere in this typing task. Please do your best to be as accurate as possible and type the letters in the proper order without using shortcuts (key strokes will be tracked). You will receive the same pay no matter how long you do this task." Half of the participants further read: "while you are typing, you will also listen to an excerpt from an audiobook." Participants in this condition listened to a clip from the John Grisham book *A Time to Kill*.

On the next page, participants saw a media player with a 5:58 minute play time (in the tangential immersion conditions the media player played the audiobook clip, and in the control conditions no sound played and this simply served as a timer). The media player was included so that participants in both conditions would see a timer and would be asked to press a button before starting. Participants were instructed to press play, begin typing for as long as they could, and to press next at the bottom of the screen when they wished to move on.

After the typing task, participants responded to several items measuring their perceptions of the typing task: "How fun was the typing task?"; "To what extent did you enjoy the typing task?" (1 = Not at all to 7 = Very [A lot]). Next, participants responded to the 29-item Multidimensional State Boredom Scale (α = .96; Fahlman et al. 2013). To test our manipulation of the tasks' attentional demands, participants were asked: "How effortful was the typing task?"; "To what extent did it feel like you were typing on autopilot?" (1 = Not at all to 7 = Very [A lot]). Finally, to measure engagement in the story, participants indicated to what extent they were curious to hear how the clip ended (1 = Not at all to 7 = Very). Participants in the tangential immersion conditions were further asked to select which statement was true based on the story they heard (A dead man was hanging from a tree, A teacher was angry at her students, A farm had a tough winter, I didn't listen). No exclusions were made based on the listening check as incorrect responses may have been a result of focusing on the focal task (as opposed to not listening to the clip). Participants then responded to a comprehension check asking them for how long they were asked to do the typing task (For as long as I wished, For about 6 minutes, For at least 2 minutes, Not sure; participants who failed this measure were excluded). Finally, participants reported their gender identity and age.

Results

Manipulation Checks. We regressed each of the manipulation checks on dummy-coded task (low-, high-) among control participants.[6] Relative to the low-attention task (M = 3.90), the high-attention task (M = 4.92) was significantly more effortful (b = 1.02, $t(287)$ = 4.64, p <.001) and significantly less automatic ($M_{low\text{-}attention}$ = 5.35 vs. $M_{high\text{-}attention}$ = 3.45; b = -1.90, $t(287)$ = -9.22, p <.001).

Among participants who listened to the story, those who did the low-attention task (vs. high-attention) reported being marginally more curious to hear how the clip ended ($M_{low\text{-}attention}$ = 3.35 vs. $M_{high\text{-}attention}$ = 2.92; b = .43, $t(285)$ = 1.60, p = .111). Moreover, curiosity in the clip significantly correlated with persistence in the typing task (b = 33.10, $t(285)$ = 12.24, p < .001).

Persistence. We regressed time spent on effect-coded task (low-attention = 1 vs. high-attention = -1), immersion (control = -1 vs. tangential immersion = 1), and their interaction. The

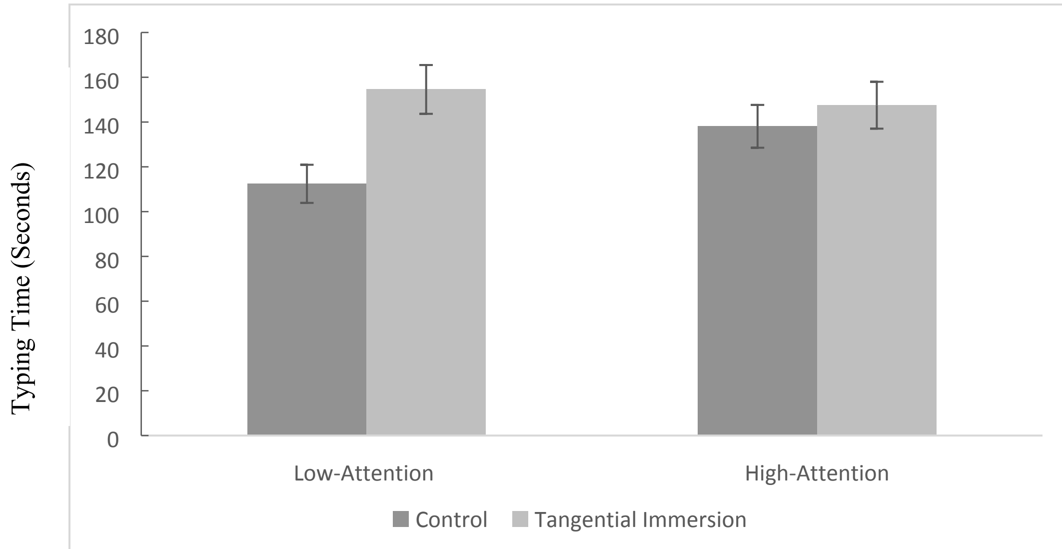
[6]Of note, while the preregistration did not specify that these two measures would be assessed only among control participants, doing so provides a cleaner test of our focal task manipulation. In addition, we deviate from some of the preregistered analyses in this experiment in order to be consistent with the analyses used in experiment 4 in the main text.

analysis revealed no main effect of task on untransformed time and a main effect of task when log-transformed (b = -4.66, t(572) = -.94, p = .350; logged: b = -.08, t(572) = -2.04, p = .042), a main effect of tangential immersion (b = 12.90, t(572) = 2.59, p = .010; logged: b = .06, t(572) = 1.60, p = .111), whereby participants who listened to an immersive story spent more time on the task, qualified by a marginal interaction for untransformed time and a nonsignificant interaction when log-transformed (b = 8.18, t(572) = 1.65, p = .100; logged: b = .06, t(572) = 1.50, p = .134; see table 6).

We extracted simple effects for typing time using an equivalent version of the regression above but with dummy-coded variables. Specifically, we dummy coded the two focal tasks (low-, high-) and dummy coded immersion (control = 0 vs. tangential immersion = 1). We ran two versions of the model and included only one of the dummy coded variables each time to extract different sets of simple effects. As predicted, within the low-attention conditions, participants who were tangentially immersed persisted significantly longer ($M_{immersion}$ = 155 seconds) than control participants ($M_{control}$ = 112 seconds; b = 42.16, t(572) = 3.14, p = .002; logged: b = .24, t(572) = 2.29, p = .022). On the other hand, within the high-attention conditions there was no simple effect of tangential immersion on persistence ($M_{immersion}$ = 148 seconds vs. $M_{control}$ = 138 seconds; untransformed: b = 9.43, t(572) = .64, p = .520; logged: b = .01, t(572) = .07, p = .947; see figure 1).

FIGURE 1

TIME SPENT ON TYPING TASK, EXPERIMENT 4S



NOTE.—Error bars represent ± 1 SEM

TABLE 6

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 4S

	Untransformed Time (1)	Logged Time (2)
Low vs. High	-4.66 (4.97)	-.08* (.04)
Tangential Immersion	12.90** (4.97)	.06 (.04)
Low vs. High* Immersed	8.18 (4.97)	.06 (.04)
Constant	138.14*** (4.97)	4.55*** (.04)
# Observations	576	576
R^2	.02	.02

NOTE.—Standard errors in parentheses. Levels of significance: *$p < .05$, **$p < .01$, ***$p < .001$. Task (low-attention = 1 vs. high-attention = -1) and immersion (control = -1 vs. tangential immersion = 1) are effect coded for proper interpretation of the main effects.

Characters Typed. Number of characters typed was assessed as a secondary measure of persistence. A regression analysis predicted number of characters typed from effect coded task (low-attention = 1 vs. high-attention = -1) and immersion (control = -1 vs. tangential immersion = 1), and their interaction. The analysis revealed a significant main effect of task ($b = 206.31$, $t(572) = 10.78$, $p < .001$), whereby participants who did the low-attention task typed more characters than participants who did the high-attention task, a significant main effect of tangential immersion ($b = 51.86$, $t(572) = 2.70$, $p = .007$), whereby participants who listened to an immersive story typed more characters, qualified by a nonsignificant interaction ($b = 26.53$, $t(572) = 1.38$, $p = .167$).

We used the dummy coded models to extract simple effects. Within the low-attention conditions, participants who listened to the immersive story typed significantly more characters than participants who listened to nothing ($M_{immersion} = 667$ vs. $M_{control} = 510$; $b = 156.79$, $t(572) = 3.02$, $p = .003$). However, there was no effect of tangential immersion on number of characters typed for participants in the high-attention conditions ($M_{immersion} = 201$ vs. $M_{control} = 150$; $b = 50.66$, $t(572) = .90$, $p = .371$).

Error Rate. To test whether tangential immersion impacted performance, we calculated a rate of typing errors using the same algorithms described in experiment 4[7] in the main text. Error rate was no different between tangentially immersed and control participants in either the low-attention ($M_{immersion} = 5.04$ vs. $M_{control} = 4.07$; $b = -.98$, $t(311) = -.51$, $p = .611$) or high-attention conditions ($M_{immersion} = 1.66$ vs. $M_{control} = .77$; $b = -.89$, $t(261) = -1.42$, $p = .157$).

Self-reported Perceptions. We used the contrast coded model to examine main effects and interactions, and the dummy coded models to extract simple effects. For the

[7] For the algorithms to run properly, participants who chose not to type any characters had to be excluded (this excludes 6 participants total).

Multidimensional State Boredom Scale, there were no simple effects, no main effects, and no interactions between tangential immersion and task (*p*s > .39).

The two items measuring perceived fun and enjoyability of the task were collapsed into a single item measuring typing-task enjoyment ($r = .95$, $p < .001$). The analysis revealed a marginal main effect of task ($M_{low\text{-}attention} = 2.44$ vs. $M_{high\text{-}attention} = 2.20$; $b = .12$, $t(572) = 1.64$, $p = .101$). There was also a marginal main effect of tangential immersion ($M_{immersion} = 2.47$ vs. $M_{control} = 2.19$; $b = .13$, $t(572) = 1.74$, $p = .082$). These effects were qualified by a significant interaction ($b = .16$, $t(572) = 2.19$, $p = .029$). There was a significant simple effect of tangential immersion on typing-task enjoyment among participants who did the low-attention task ($M_{immersion} = 2.73$ vs. $M_{control} = 2.15$; $b = .58$, $t(572) = 2.91$, $p = .004$). Tangential immersion, however, did not affect typing-task enjoyment among participants who did the high-attention task ($M_{immersion} = 2.17$ vs. $M_{control} = 2.23$; $b = -.07$, $t(572) = -.30$, $p = .761$).

Discussion

Experiment 4s replicates the effect of experiment 4 in the main text with a different population and a different tangential task, thus further supporting our hypothesis that tangential immersion increases persistence, but only when the focal task requires low levels of attention.

In this experiment, participants who were tangentially immersed while doing the low-attention task reported enjoying the typing task more than participants in the control condition. This result is consistent with previous findings that people attribute the negative affect associated with boredom to the task at hand (Critcher and Gilovich 2008; Damrad-Frye and Laird 1989; Fisher 1993). However, because the post-hoc perception measures do not replicate consistently across experiments, we do not speculate further about these results.

EXPERIMENT 5 PRETEST

We conducted a pretest to assess whether our tangential task stimuli were considered more (vs. less) immersive. Four hundred two Amazon Mechanical Turk workers completed a study in exchange for payment. Eight participants reported not doing the tangential task as instructed and were excluded. Thus, three hundred ninety four participants were included in the analysis (49% female).

Participants were randomly assigned to one of four tangential tasks: watch a dot scrolling across the computer screen (control); listen to a story (listen); read a story scrolling across the computer screen (reading); or, add a list of numbers scrolling across the screen (addition). The control and reading conditions were the same as in experiment 2. The media file for each condition displayed the same length (3:48 seconds), consistent with the manipulation in the main experiment 5 study; however (unbeknownst to the participants ahead of time), they were automatically forwarded after one minute. On the next page, participants responded to the same 3-item immersiveness scale from experiment 2 designed to measure how much the video captured and sustained their attention: “To what extent did this task capture your attention?”; “How engaging was this task?”; “How much was your mind wandering while doing this task (i.e., how much were you thinking about things unrelated to the task?)” on seven-point likert scales (1 = Not at all to 7 = Very [A lot/Very much]). Finally, participants indicated whether they did the task as instructed and reported their gender identity.

EXPERIMENT 5

Experiment 5: Full Text Instructions

Screenshot of instructions for participants in the control condition:

On the next page, you will see an image of a scrolling dot.

For multi-tasking purposes, you will do a coordination exercise while watching the dot. While you are watching to dot (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm out straight for the entire time that you are watching the scrolling dot. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop watching the scrolling dot and move on to the next page.

Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

Screenshot of instructions for participants in the Listening Condition:

On the next page, you will listen to a short story.

For multi-tasking purposes, you will do a coordination exercise while listening. While you are listening to the story (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm out straight for the entire time that you are listening. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop listening and move on to the next page.

Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

After you finish listening, you will be asked to answer a few questions about the content of what you heard.

Screenshot of instructions for participants in the reading condition:

On the next page, you will read a short story.

For multi-tasking purposes, you will do a coordination exercise while reading. While you are reading the story (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm straight out for the entire time that you are reading. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop reading and move on to the next page.

Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

After you finish reading, you will be asked to answer a few questions about the content of what you read.

Screenshot of instructions for participants in the addition condition:

On the next page, you will add a list of numbers.

For multi-tasking purposes, you will do a coordination exercise while adding. While you are adding the list of numbers (on the next computer screen), we ask that you hold your arm straight out to the side with your phone in your hand, just like in the picture below.

You must hold your arm out straight for the entire time that you are adding numbers. Feel free to stop whenever you want.

When you stop holding your arm out straight, you must stop adding the numbers and move on to the next page.

Try to do this task for as long as you can. Participants who last above average will be entered into a lottery to win an Amazon gift card for $25.

After you finish adding, you will be asked to enter the total number that you summed.

On the next page, participants held out their arm while doing the tangential task (screen shots below of the video each participant watched/listened to).

Screenshot of the control condition tangential task:

Screenshot of the listening condition tangential task (audio played):

Screenshot of the reading condition tangential task:

Screenshot of the addition condition tangential task:

Experiment 5: Robustness Checks and Additional Measures Not Reported in Main Text

Persistence. As described in the main text, the primary dependent variable in this study is persistence in the coordination exercise among participants in the listening, reading, and addition conditions (vs. control; see table 7).[8]

TABLE 7

LINEAR REGRESSIONS PREDICTING PERSISTENCE, EXPERIMENT 5

	Untransformed Time (1)	Logged Time (2)
Condition: Listen	16.09 (13.92)	.18 (.12)
Condition: Read	29.11* (13.92)	.21+ (.12)
Condition: Add	-17.74 (14.16)	-.11 (.12)
Constant	164.95*** (9.90)	4.97*** (.08)
# Observations	176	175
R^2	.07	.06

NOTE.—Standard errors in parentheses. Levels of significance: + $p < .10$ *$p < .05$, **$p < .01$, ***$p < .001$.

[8] One participant has a time of 0 seconds listed. This participant was removed only for the logged time analysis.

Additional Measures. Prior to running each participant, the research assistant (RA) recorded which breakout room they were in, their own (the RA's) gender, and their own (the RA's) initials. Persistence remains significantly longer in the reading condition (vs. control condition) when controlling for each of these measures (*ps* < .040).

Robustness Checks. As robustness checks, participants indicated the size of their phone (large screen/small screen), their handedness (right, left, ambidextrous), and which arm they held out. The majority of participants reported being right-handed (89%), holding out their right arm (33%), and having a large-screen phone (68%). Persistence in the reading condition (vs. control) remains consistently longer when controlling for these measures (*ps* < .039).

Future Directions

Our sum-level model of attention suggests that together a focal task and tangential task should demand a level of attention that aligns with one's attentional capacity. How much attention a low-attention task demands varies across tasks and contexts—for instance, walking around a track can be done almost completely automatically, whereas walking down a busy street may require more attention (watching out for cars and other people). Although we would predict that both scenarios would benefit from tangential immersion, it is likely that the lower-attention scenario (walking around the track) would pair better with a more attention-demanding tangential task (e.g., an immersive audiobook), while the context that requires more attention (walking down a busy street) may do better with a tangential task that requires less attention (e.g., listening to a popular song). Future research could explore different combinations of focal and tangential tasks that vary in how much attention they demand.

Also relevant is whether tangential immersion changes behaviors over time. Here we show tangential immersion increases persistence within a single period. Future research could examine the effect of tangential immersion over repeated periods. Specifically, might it increase the likelihood that consumers develop healthier habits (Ouellette and Wood 1998; Wood, Quinn, and Kashy 2002)? Considering how tangential immersion could impact long-term engagement in low-attention behaviors would be a worthy endeavor.

Additional work could also build upon the boundary conditions presented in this initial investigation. We found participants did not persist in a focal task longer when the *focal* or when the *tangential* tasks required too much attention. Investigating the fragility of these boundaries and pinpointing the exact balance of optimal attentional demands between tasks is a logical next step. We contend that reaching an optimal range of attention varies by individual based on three elements: an individual's own attentional capacity; the amount of attention the focal task demands (e.g., jogging would be a low-attention focal task for someone who runs daily, but might be a high-attention task for an occasional runner); and how much attention is demanded by the tangential task (e.g., we found that an addition task demanded too much attention for the average person, but this might not be the case for an MIT math-wiz). Future research could investigate more precisely how to reach an individual's optimal range of attention without falling under and demanding too little attention, or surpassing and demanding too much.

Although tangential immersion increases persistence in low-attention behaviors, by decreasing boredom it may influence consumers in other unintended ways. There is growing evidence that, at times, boredom can be a healthy and necessary motivator, encouraging people to make positive changes by seeking out more interesting activities (Westgate et al. 2018), and even inspiring creativity (Baird et al. 2012). Future research might investigate contexts in which tangential immersion decreases otherwise creative breakthroughs. More generally, exploring additional consequences of tangential immersion could be a fruitful area for future inquiries.

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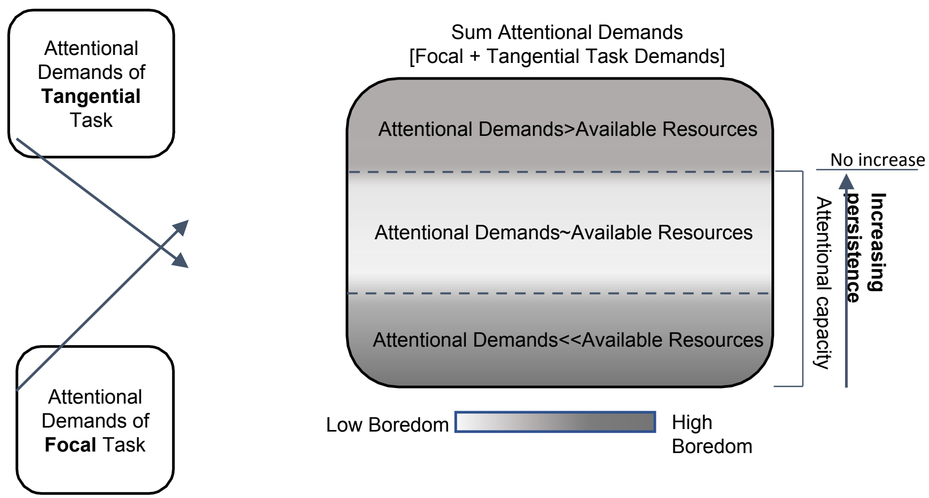
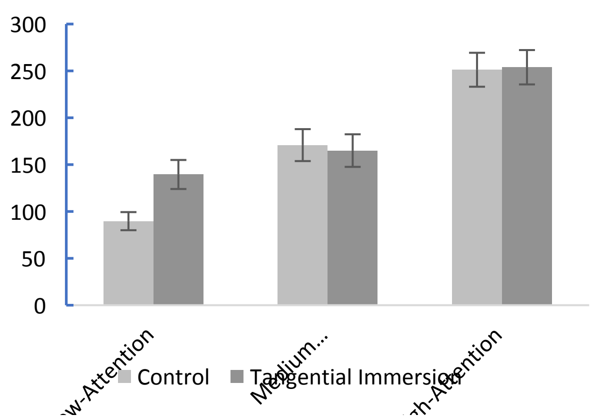

Attentional Demands of **Tangential** Task
Attentional Demands of **Focal** Task
Sum Attentional Demands
[Focal + Tangential Task Demands]
Attentional Demands>Available Resources
Attentional Demands~Available Resources
Attentional Demands<<Available Resources
No increase
Attentional capacity
Increasing persistence
Low Boredom
High Boredom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250
200
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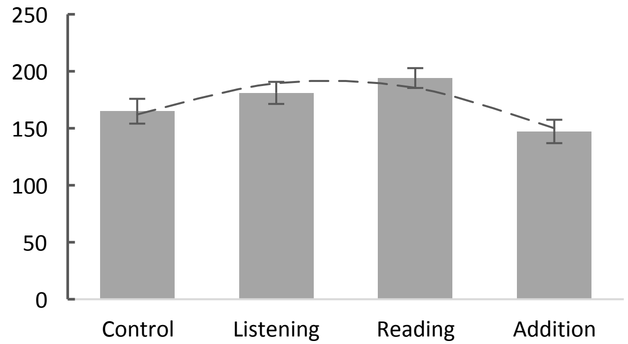
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200
150
100
50
0
Control
Listening
Reading
Addition