Inferring Attitudes From Mindwandering

Personality and Social Psychology Bulletin
36(9) 1255–1266

DOI: 10.1177/0146167210375434
http://pspb.sagepub.com
SAGE

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Abstract

Self-perception theory posits that people understand their own attitudes and preferences much as they understand others', by interpreting the meaning of their behavior in light of the context in which it occurs. Four studies tested whether people also rely on unobservable "behavior," their mindwandering, when making such inferences. It is proposed here that people rely on the content of their mindwandering to decide whether it reflects boredom with an ongoing task or a reverie's irresistible pull. Having the mind wander to positive events, to concurrent as opposed to past activities, and to many events rather than just one tends to be attributed to boredom and therefore leads to perceived dissatisfaction with an ongoing task. Participants appeared to rely spontaneously on the content of their wandering minds as a cue to their attitudes, but not when an alternative cause for their mindwandering was made salient.

Keywords

self-perception theory, mindwandering, constructed preferences, revealed preferences, self-insight, attribution

Received February 18, 2009; revision accepted March 30, 2010

People often confront the difficult task of having to infer someone else's attitudes and preferences (Epley & Waytz, 2009). Finding a friend an appropriate gift, deciding on joint activities for a family vacation, and signing up the kids for extracurricular activities all require making inferences about what other people are likely to find appealing. We sometimes have fairly direct access to that information. We may observe a person squeal with delight while watching the latest sitcom. As a birthday approaches, an acquaintance may hand us a "wish list," making his or her preferences brazenly clear. At other times, we have only indirect indicators of another's preferences. Does she frequently or only occasionally go biking? Did he freely choose to go to the Thai restaurant, or did his friends insist? Was she riveted during our trip to the theater, or was she mostly gazing at her watch?

According to self-perception theory, we make inferences about our own preferences in much the same way that we make judgments about someone else's (Bem, 1972; Schnall & Laird, 2003). Just as we might infer that Sarah is enjoying a date by observing the smile on her face, our own facial expressions influence our assessments of our own emotional experience (Adelmann & Zajonc, 1989; Duclos et al., 1989; Izard, 1990; Zajonc, 1968). And just as we often use more indirect indicators to infer others' preferences, we use similar inferential logic to make judgments about ourselves. For example, although mild reinforcement can help sustain rewarded behaviors (e.g., Casey & Rozin, 1989), unnecessarily large reinforcements can backfire, leading people to infer that it was the external reward that drove their interest in the task (Lepper, Greene, & Nisbett, 1973; Newman & Taylor, 1992). In combination, these observations suggest that people do not always access their own preferences directly. Just as one uses contextual information to decipher the preferences of others, one similarly relies on such information to discern one's own preferences.

Self-perception theory emerged from a behaviorist tradition that saw no role for internal experience in a scientifically rigorous approach to psychology. It thus downplayed the importance of internal states and stuck closely to the inferences people make on the basis of overt behavior. Skinner (1953) argued that people cannot learn to reliably label internal states in the same manner as they can external events and dismissed efforts to look at anything other than observable stimuli and responses in trying to understand behavior. Taking a milder approach, Bem (1972) argued that internal cues are often "weak, ambiguous, or uninterpretable" (p. 2) and accordingly maintained that people often

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need to rely on their own external behavior to understand their internal preferences.

But not all internal cues are weak, ambiguous, or uninterpretable. One type of inner "behavior" that people can readily describe is their *mindwandering*. What may be ambiguous and difficult to interpret in this case is not the content of the mindwandering itself, but what conclusions can be drawn from it. Mindwandering occurs while engaged in other activities and therefore might be used as a cue to understanding one's attitude toward an ongoing activity. But when do people use mindwandering as a cue to their own boredom with the task at hand, and when is it dismissed as a meaningless, fleeting moment of mental distraction? We examine how people resolve this attributional dilemma and make inferences about their enjoyment of an activity based on the *content* of their free-floating thoughts about things other than the activity itself—that is, their mindwandering.

The mind often wanders, especially under conditions of low sensory input, with sleep being perhaps the most extreme case (Hobson, 1988; Klinger, 1978; Pope, 1978). The voluntary control of attention is simply not up to the task of entirely preventing the mind's tendency to wander (James, 1890). In fact, efforts to hold one's attention in one place and not let distractions enter into consciousness may ironically increase the amount of mindwandering (Wegner, 1997). It also appears that the default mode of mental activity—the "baseline" neural activity that corresponds to a resting state (Raichle et al., 2001)—corresponds to associative thought experienced as mindwandering.

Do people consider the specific content of their wandering minds to be informative about their feelings toward their ongoing experience? More specifically, might people hold "naive theories" concerning what their mindwandering signals about their attitudes toward what they are doing? People hold a variety of naive theories that help them draw inferences about the meaning of their cognitive and metacognitive experiences (e.g., Winkielman & Schwarz, 2001). Such theories offer parsimonious and often-valid explanations for what an experience might signal, but they can also be overapplied and thus lead to questionable conclusions. For example, the experience of processing fluency produces positive affect, but people often interpret their positive state without reference to fluency, accounting for their fluency-induced positive affect by assuming that they like the stimuli to which they are currently exposed (Winkielman, Schwarz, Fazendeiro, & Reber, 2003).

What might people's theories of mindwandering entail? Unkelbach (2006) argues that despite their potential to lead people astray, naive theories are ultimately rooted in the ecological validity of the cues that are utilized. Thus, if we knew how boredom actually influences mindwandering, we could predict when mindwandering might be assumed to reflect boredom. One obvious candidate for such a cue, how often the mind wanders, may be less tightly connected to boredom than it might seem at first glance. For one thing, attempts to selectively focus on a task can backfire and produce greater mindwandering (Wegner & Erber, 1991). To the extent that one *needs* to focus one's attention on tasks that are not engaging to begin with, less enjoyable tasks may often be associated with relatively little mindwandering (when control of attention is successful) or more mindwandering (when the backfiring occurs). Furthermore, activation in the default mode, experienced as mindwandering, decreases to the extent to which one is performing a more demanding task (Gusnard & Raichle, 2001; McKiernan, D'Angelo, Kaufman, & Binder, 2006). But how demanding a task is, in itself, does not make a task more or less enjoyable (Csikszentmihalyi, 1990). It is therefore hard to make a clear prediction about any ecologically valid connection between the frequency of mindwandering and enjoyment. This suggests that mindwandering, by itself, may not have a consistent influence on one's perceived enjoyment of an ongoing task.

Mindwandering confronts a person with a challenging attributional dilemma: Does a wandering mind signal boredom, or does it suggest a particularly compelling property of the object of one's wandering mind? At times this dilemma is easily resolved because there is a clear reason why one is distracted. For example, a student would not infer that he did not like a novel if he had trouble maintaining focus while his roommates were hosting a raucous dance party just beyond the bedroom door (see Damrad-Frye & Laird, 1989). Under other circumstances, the cause of a wandering mind might be more ambiguous, leading people to turn to the precise *content* of their aimless thoughts to explain their occurrence.

Boredom can be conceived as a state of low stimulation that leads to inattention, daydreaming, and performance errors that stem from a need for change and excitement (Berlyne, 1970; Fiske & Maddi, 1961; Wyatt, Langdon, & Stock, 1937). We therefore expected that when a wandering mind focuses on activities that are positive, fun, and exciting, it may be interpreted as a signal of boredom with an ongoing activity because such thoughts represent "solutions" to the problem at hand—tedium replaced by excitement. Mindwandering that focuses on less exciting activities, in contrast, may tend to be seen as less informative—as idle thoughts that can have any number of causes.

In general, cues that suggest that one's mind is being drawn to a particularly compelling object (e.g., "That fight was so upsetting! I keep replaying it in my mind."), should forestall an inference that a wandering mind signals boredom with a current focal activity. Beyond the positivity of the mindwandering content, the general rules of attributional logic suggest two additional cues that should signal, or forestall, an inference of boredom with the ongoing, focal activity (Kelley, 1967, 1973). First, to the extent that the mind wanders to a single event, it is unclear whether to attribute it to boredom with a current activity or to the compelling quality of the imagined event in question. But if the

mind wanders diffusely to multiple events, the various targets of one's wandering mind are not distinctive, making an inference to the self—that is, to boredom with the focal activity—more compelling. Second, when the mind wanders to an enjoyable event from the past, rather than an activity one could be doing right now, the mind has been drawn to one event out of a huge set of possible memories. The distinctiveness of this memory intruding on consciousness suggests there is something particular about this memory that attracts attention. This makes mindwandering appear less informative about one's present satisfaction. In contrast, one usually has only a few alternative activities one might be doing at any moment ("I've got to stop thinking about the Sudoku I'd be doing if I weren't writing this now"), and mindwandering of that sort may suggest that one is bored and wishes one were doing that activity instead.

Pilot Study

We conducted a pilot study ($n = 206$) to assess whether there is indeed a correlation between people's satisfaction with an ongoing experience and the extent to which their minds wander to enjoyable events that they could have been doing instead, and whether that relation is mediated by participants' explanations for their mindwandering. Participants in this study, and all studies reported here, received extra course credit for their participation. They arrived at the lab and watched two 11-min episodes of the children's television show *SpongeBob SquarePants* in private cubicles.

A week before coming to the lab, participants expressed how much they tended to enjoy various activities from 1 (*not at all*) to 10 (*extremely*). Embedded in this list was "watching the television show *SpongeBob SquarePants*."

After watching the episodes, participants answered four questions about their mindwandering. First, they were told that while engaged in a task, people's minds often wander to what they might have been doing if they were not taking part in their present activity. Participants were first asked if their mind ever wandered to what they would have been doing had they not been in the lab. All but one participant indicated that theirs did. This participant was therefore dropped from the analyses. Next, participants rated the object of their mindwandering in terms of "how enjoyable this activity was" on a scale from 1 (*not at all*) to 11 (*extremely*).

We explained that sometimes mindwandering can signify one's degree of satisfaction or dissatisfaction with an ongoing task, whereas at other times it is not informative and merely reflects one's mind being attracted to different things. To assess participants' explanations for their mindwandering, participants indicated on 9-point scales the extent to which their mindwandering "signaled their degree of (dis)satisfaction with the *SpongeBob* episodes" and how much their mindwandering "had nothing to do with how much [the participant] did or did not enjoy the *SpongeBob* episodes," both from 1 (*not at all*) to 9 (*completely*). The items were negatively correlated, $r(201) = -.65$, $p < .001$. After reverse scoring the second item, we summed the items, so that higher values on the *explanation for mindwandering* index reflected a greater belief that the mindwandering stemmed from participants' (lack of) enjoyment with the episodes.

Three items measured how much people enjoyed the episodes: "Based on your enjoyment of these episodes, how likely would you be to watch an episode of *SpongeBob SquarePants* in the future?", "Would you agree that *SpongeBob* might be enjoyable to kids, but it is somewhat painful for adults?" (reverse scored), and "Would you say that the episodes were dull?" (reverse scored). All were expressed on 11-point scales, from 1(*not at all*) to 11(*completely/extremely*). This composite had good internal reliability ($\alpha = .79$).

All analyses control for preexisting liking of *SpongeBob SquarePants*. Holding preexisting enjoyment constant, to the extent that participants' mindwandering took them to more positive or enjoyable activities, they reported enjoying the *SpongeBob SquarePants* episode less, $\beta = -.11$, $t(200) = 2.08$, $p = .04$. Furthermore, those whose minds wandered to more positive activities thought that their mindwandering was more of a signal of their level of dissatisfaction with the television episode, $\beta = .14$, $t(200) = 2.31$, $p = .02$. Finally, simultaneously regressing episode enjoyment on the measures of mindwandering valence and mindwandering attribution revealed a significant effect of mindwandering attribution, $\beta = -.34$, $t(200) = 6.35$, $p < .001$, which eliminated the effect of mindwandering valence, $\beta = -.06$, $t(200) = 1.21$, $p > .22$. A Sobel test confirmed the significance of the full-mediation model, $z = 2.17$, $p = .03$.

Overview of the Present Studies

Our pilot study suggests that there is a relation between enjoyment of a focal activity and the content of a person's mindwandering. To investigate this relation further, we tested, in both hypothetical situations and laboratory experiences, the hypothesis that people attend to the content of their mindwandering to understand why their mind is adrift and what it says about their enjoyment of the activity in which they are currently engaged.

The studies proceed along two tracks that converge to provide support for our hypotheses. First, the studies systematically examine different moderators hypothesized to influence whether people interpret their mindwandering as a reflection of boredom with the focal activity or of unrelated causes. In Study 1, we manipulated the valence of mindwandering. Study 2 manipulated whether mindwandering was to a concurrent event or a past event. In Study 3, mindwandering either was focused on one particular alternative event or diffusely meandered among a number of positive events. We expected that diffuse mindwandering to enjoyable, concurrent events would be seen as more indicative of boredom

with a focal activity than mindwandering to specific, tedious, or past events. In Study 4, we highlighted to some participants that our mindwandering manipulation was likely responsible for their thoughts drifting in a particular direction. We expected that this would make it less likely that participants would interpret their mindwandering as a sign of their level of satisfaction with the focal activity.

Second, the studies sequentially examine each step in our proposed process: from attributions about mindwandering to effects on reported enjoyment. Study 1 tested whether mindwandering is attributed to dissatisfaction with a focal activity or to unrelated causes. Study 2 connected the attributions for mindwandering to the specific inferences participants draw about their own task enjoyment. Study 3 examined task satisfaction directly. Study 4 used a misattribution paradigm to test whether people no longer infer dissatisfaction with an ongoing focal activity when they have another salient explanation for their wandering minds. Studies 1 and 2 therefore show that people reason according to the attributional logic we propose, and Studies 3 and 4 show that people spontaneously draw on such logic to infer their own degree of satisfaction with a focal task. By examining the attribution process separately from the direct inferences of enjoyment, we can be confident from the results of the latter studies that people infer a level of task enjoyment that is consistent with such attributional logic even in the absence of attribution measures that might artificially prompt an attributional process that would not have otherwise occurred.

Finally, in line with the history of research on self-perception theory, we both manipulate the content of people's mindwandering as they engage in actual activities (Studies 1 and 4) and tap their inferences about mindwandering in the context of hypothetical scenarios (Studies 2 and 3). Parallel results across these different paradigms would buttress our claim that people understand their own mindwandering in actual situations much as would an "outside" observer given the pertinent facts.

Study 1

We experimentally manipulated the valence of participants' mindwandering and then tested whether this influenced their attributions for why their minds drifted elsewhere. The pilot study demonstrated that mindwandering to positive events was related to diminished satisfaction with a current activity and that the relation was mediated by participants' belief that their mindwandering was an indication of current boredom. Study 1 goes beyond the pilot study in two important ways. First, by manipulating participants' mindwandering, we can test the causal hypothesis that the valence of mindwandering leads to different explanations for its occurrence. Second, we were careful to measure attributions for mindwandering using "enjoyment-neutral" language that would not be confused with a measure of task enjoyment itself. We merely asked participants to judge whether their mindwandering indicated their "degree of satisfaction or dissatisfaction" with the task or reflected "the attracting nature of where one's mind was wandering." We predicted that those whose minds had been induced to wander to enjoyable alternatives would see their mindwandering as more reflective of (dis) satisfaction with the focal activity than those induced to mindwander to less enjoyable alternatives.

Method

Participants and design. Two hundred thirteen Cornell University undergraduates were randomly assigned to either the positive or negative mindwandering condition.

Procedure. Participants were told that the study was part of a large sociological project examining how college students spend their time. Depending on condition, participants then received one of two versions of the manipulation. At the top of the instruction sheet, in large font, was written, "If I weren't here . . ." In the positive [negative] condition, the instructions began, "Researchers at Cornell and other universities are creating a catalog of how college students spend their leisure time [of the time obligations faced by today's college students]." Participants were told that the researchers were employing a "counterfactual sampling method," and so they should indicate "how you would be enjoying yourself [what tasks and obligations you would have to do] if you were not in the lab today." Participants spent 5 min providing specific information about how they would have spent their time.

Next, for the focal activity, participants were told that the researchers were also interested in how people respond to experiences they have inside the laboratory. Each participant was told that he or she had been randomly assigned to the "puzzle condition." Participants were then escorted to an adjacent room with a jigsaw puzzle displayed on a table. The border of the puzzle had already been constructed. Both the remaining pieces and the puzzle box, which showed what the completed puzzle would look like, were located to the side. Participants were told that they should work on the puzzle for 15 min, at which point they would be led to another room and asked a few questions about their experience. While the participant completed these questions in the other room, the experimenter counted how many of the puzzle pieces had been put together.

As part of the dependent measures, participants were asked whether, while working on the puzzles, their minds ever wandered to what they would be doing if they were not in the lab that day. Seven participants indicated it did not. These participants were therefore dropped, leaving 206 participants in all analyses reported here. As a check on the manipulation, we asked participants to consider the activities to which their minds wandered and to rate how enjoyable those activities were. Participants responded on a scale from 1 (*not at all*

enjoyable) to 11 (*extremely enjoyable*). In addition, participants indicated how frequently their minds wandered during the task, from 1 (*almost never*) to 11 (*all the time*). Finally, participants read that sometimes people's minds wander because of how satisfied they are with what they are doing, whereas other times their minds wander for unrelated reasons. Participants then rated the extent to which their "wandering mind signaled [their] level of satisfaction or dissatisfaction with the puzzle" on a scale from 1 (*not at all*) to 9 (*completely*).

Results

The mindwandering manipulation was effective in influencing what participants thought about when their thoughts drifted from the task at hand. Those who first concentrated on fun experiences reported thinking about more enjoyable alternative activities while working on the puzzle ($M = 6.07$, $SD = 2.60$) than did those who wrote about duties and obligations ($M = 4.95$, $SD = 2.52$), $t(204) = 3.13$, $p = .02$. The manipulation did not appear to influence the frequency of mindwandering (Ms = 4.19 and 4.70), $t(204) = 1.36$, $p > .17$.

Consistent with our hypothesis, participants in the positive condition thought that their mindwandering was more indicative of their degree of (dis)satisfaction with the puzzle ($M = 5.21$, $SD = 2.41$) than did those in the negative condition ($M = 4.53$, $SD = 2.13$), $t(204) = 2.17$, $p = .03$. Further confirming the hypothesis, participants' ratings of how much they would enjoy the alternative activities they thought about were correlated with the extent to which they interpreted their mindwandering as diagnostic of their (dis)satisfaction with the puzzle, $r(204) = .15$, $p = .04$. Both results remained significant when controlling for the frequency of mindwandering.

Even though we observed a main effect of condition on the crucial attribution measure, we conducted a supplemental analysis to further test our hypothesis and to examine our assumption that participants' attributions about enjoyment reflect attributions of *dis*satisfaction. We expected participants to be especially likely to interpret their mindwandering as a sign of boredom when there was further reason to believe that they might not be enjoying the activity. We thus predicted that (positive) mindwandering would be especially likely to be seen as diagnostic of (dis)satisfaction with the jigsaw puzzle when participants were not doing well on the task. That is, an inference of boredom with the focal task would seem most compelling in a context in which one was not making much progress on the task. For example, the possibility that one may not be enjoying a book more naturally suggests itself when one is stuck on one page for several minutes.

Accordingly, we regressed participants' ratings of the degree to which they saw their mindwandering as diagnostic of their feelings about the puzzle on: (a) the positivity of their mindwandering experience, (b) the number of puzzle pieces they had completed, and (c) their interaction. As depicted in Figure 1, a significant interaction emerged between participants' ratings of the activities to which their minds wandered and the number of puzzle pieces they completed, $\beta = -.19$, $t(201) = 2.77$, $p = .01$.[1] To further probe this interaction, we conducted simple slopes analyses 1 *SD* above and below the mean number of puzzle pieces completed (Aiken & West, 1991). Although there was no relation between mindwandering valence and perceived diagnosticity of mindwandering for those who had completed a fair amount of the puzzle, $\beta = -.03$, $t < 1$, there was a strong relation between the two for those who had not completed much of the puzzle, $\beta = .35$, $t(201) = 3.37$, $p = .001$. To make certain that it was not simply that those who made more progress on the puzzle showed less sensitivity to mindwandering because their minds wandered less, we repeated the regression controlling for frequency of mindwandering and the interaction between the frequency of mindwandering and the number of pieces completed. We found that the original interaction between the positivity of participants' mindwandering and the number of puzzle pieces completed remained significant, $\beta = -.17$, $t(199) = 2.34$, $p = .02$. Furthermore, this interaction (and the mediation observed in the pilot study) makes implausible an alternative account that mindwandering valence exerts its effect through a simple contrast effect.

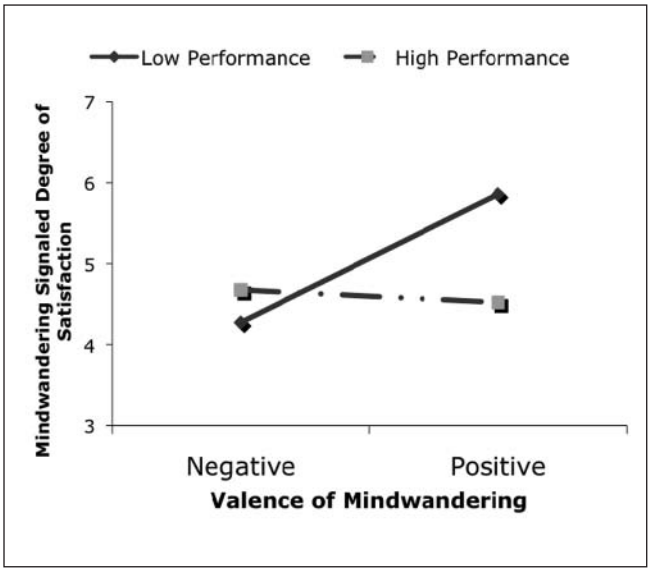

Figure 1. The extent to which participants interpreted their mindwandering as a signal of their (dis)satisfaction with the puzzle activity, by condition
Plotted values are those predicted ±1 *SD* from the mean mindwandering valence and puzzle performance (Study 1).

Discussion

By experimentally manipulating where their minds were likely to go, we led participants to see their mindwandering as more

or less indicative of their enjoyment of the focal task. The more enjoyable the alternative activities they considered, the more they took their mindwandering to be a reflection of their level of (dis)satisfaction with the assigned task. This relation held when controlling for the frequency of mindwandering, indicating that people are sensitive to the content of their idle thoughts, independent of their frequency. That is, it is not simply that people believe that if they are highly distractible, they must be having less fun. Participants seemed to draw this inference most strongly, furthermore, when there was additional evidence that they might not be enjoying what they were doing: when they were not making much progress on the task at hand. This lends support to our assumption (supported by the pilot study) that the inferences made by participants whose minds wandered to positive events and activities were inferences of *dis*satisfaction with the current task.

Study 2

Study 2 builds on Study 1 by examining attributions for mindwandering in more detail. We hypothesize that when people's minds wander to enjoyable things they could be doing at present, they interpret this as an indication that they are bored with the task at hand. In short, an obvious answer to the question of why their mind is drawn to such an event is that "I am bored, and I wish I were doing it instead."

The attributional logic people employ is likely to be different when the mind wanders to past events. In the present study, we therefore had participants imagine that their mind had wandered either to an enjoyable event that was happening at that moment (concurrent-mindwandering condition) or to an enjoyable event that had happened the week before (past-mindwandering condition). We anticipated that participants would interpret mindwandering to the past as less diagnostic of their feelings about the focal activity (because their mind was drawn to that particular event rather than many others) than mindwandering to a concurrent activity.

Method

Participants and design. One hundred one Cornell University undergraduates were randomly assigned to one of two mindwandering conditions: concurrent or past.

Procedure. All participants were asked to imagine that they had bought a plane ticket to visit their family over spring break.

> After you purchased this ticket, some of your friends tell you that they have planned a cross-country road trip for Spring Break and invite you to come. The trip home and the road trip would be fun, just in different ways, so you decide to go ahead with the trip home.

Participants were then asked to imagine that the trip home was fairly typical: a mixture of time with family and high school friends. But the final sentence varied by condition: "While home you find your mind often wandering to thoughts of being on the road trip with your friends [being at a particularly fun party you went to the week before going home]."

Participants then answered three questions about what they would infer if their mind had wandered in the manner described: "My wandering mind is a signal of how satisfied I am with my trip home," "My mind wanders to what I wish I were doing," and "My mind is naturally drawn to attractive alternatives regardless of how much fun I am having." These questions cover the fundamental distinction between attributions to boredom (the first two attributions) and attributions to unrelated causes (the last attribution).[2] We reverse scored the final item, standardized each, and averaged them to create a composite measure of the extent to which participants saw the stated mindwandering as a signal of dissatisfaction ($\alpha = .63$). Finally, participants were asked, "Given what you read above, how much fun do you think you would have had on the roadtrip?" Responses to all four questions were made on scales anchored at 1 (*not at all*) and 11 (*completely*).

Results and Discussion

Even though the mind was said to wander to something enjoyable in both conditions, the attribution composite differed between conditions, $t(99) = 3.85$, $p < .001$, indicating that participants interpreted mindwandering to a concurrent event to be more of a reflection of boredom with a current activity than mindwandering to a past event. Broken down by item, concurrent mindwanderers saw their mental drift as more of a signal than past mindwanderers of how (dis)satisfied they were with their trip home, $t(99) = 1.97$, $p = .05$; more indicative of what they wish they were doing instead, $t(99) = 2.74$, $p = .01$; and less a product of being "naturally attracted" to alternative possibilities that have nothing to do with how much fun one is having, $t(99) = 3.57$, $p = .001$. The means and effect sizes are listed in Table 1.

Recall that participants also indicated how much fun they thought the road trip would have been. Did they assume that the positive activities that captured their wandering minds were likely to be especially enjoyable? Apparently not. Those asked to imagine that they were constantly thinking about the trip did not think the trip would have been any more fun ($M = 8.12$, $SD = 1.79$) than those asked to imagine that their minds were focused on the prior week's party ($M = 7.88$, $SD = 1.58$), $t < 1$. Instead, the inferences that participants drew centered on what they were doing when the mindwandering was happening (the trip home) and not the object of mindwandering.

In the pilot study and Study 1, we found that the strength of the inferences participants drew about their mindwandering depended on the positivity of their thoughts. Conceptually replicating these results, thoughts about the road trip they could have taken were seen as a stronger signal of boredom

Table 1. Attributions for Mindwandering, by Condition (Study 2)

	Concurrent	Past	*p*	*d*
"My mind is naturally drawn to attractive alternatives regardless of how much fun I am having."	5.06	6.92	.001	.72
"My wandering mind is a signal of how satisfied I am with my trip home."	6.38	5.41	.05	.40
"My mind wanders to what I wish I were doing."	7.72	6.63	.01	.55
Mindwandering indicates boredom (*z*-score composite)	0.36	–0.36	< .001	.77

The composite was constructed by standardizing each item, reverse scoring the first item, averaging the three *z*-scores, and standardizing the composite.

with their trip home to the extent that the road trip was thought to be more fun, $r(48) = .37$, $p = .01$.

Study 1 demonstrated that mindwandering to positive alternative events was assumed to be more diagnostic of (dis)satisfaction with an ongoing activity than was mindwandering to negative events. Study 2 extended that result by examining more precisely the attributional logic people employ to understand the significance of their wandering minds. Furthermore, we drew from the self-perception playbook by demonstrating that such inferences emerge even when participants merely "simulate" mindwandering episodes (Bem, 1972). In combination, Studies 1 and 2 show that people use the specific content of their idle thoughts to determine whether their mindwandering reflects boredom or an uninformative moment of mental drift.

Study 3

The previous studies examined the explanations people offer for their wandering minds, and how such explanations depend on two factors—positivity and concurrence. Study 3 builds on these results in two ways. First, we examined a third factor that was expected to moderate the inferences people draw from mindwandering. Some participants were asked to imagine that their mindwandering was diffuse (frequently wandering to three different concurrent activities), whereas others were asked to imagine that their minds kept returning to a single alternative activity. It was expected that a diffuse state of mindwandering would be attributed to one's boredom, whereas more focused mindwandering would be attributed to something particularly attractive about the specific object of one's mindwandering. Second, our dependent measures in Studies 1 and 2 explicitly asked participants about their attributions for mindwandering. One might question whether people actually use such attributional logic in evaluating their satisfaction with an ongoing activity when not prompted to do so. In other words, do people naturally draw conclusions about their enjoyment of an ongoing activity on the basis of the contents of their wandering minds? To find out, we simply asked participants in the final two studies how much they enjoyed the focal activity.

Method

Participants and design. Two hundred eight Cornell University undergraduates took part in the study as part of a longer experimental session. Participants were randomly assigned to a multiple-alternative or single-alternative condition.

Procedure. Participants were asked to imagine that they had agreed to attend a movie on Friday night with people they had just met. They were told that "the movie sounds like something you would be interested in, though the reviews were only slightly above average." Then, all participants were asked to imagine that "while watching the movie, you find your mind frequently wandering." Those in the multiple-alternative condition read that their minds frequently wandered to "a party going on where you live, a dinner outing some of your friends from your major had invited you to go on, and a comedy show going on on North Campus." Those in the single-alternative condition read that their mind frequently wandered to only one of these three events.

Participants were then asked, "Based on the information above, to what extent do you think that you enjoyed the movie?" Participants responded on an 11-point scale anchored at 1 (*not at all*) and 11 (*completely*). We opted to use a single-item measure because of the straightforward nature of what it means to enjoy a film.

Results and Discussion

As predicted, participants who were asked to imagine that their mind kept going to multiple events inferred that they would have enjoyed the film less ($M = 4.38$, $SD = 1.83$) than participants who were asked to imagine that their mind kept going to a single event ($M = 4.95$, $SD = 1.83$), $t(206) = 2.27$, $p = .02$. Furthermore, the enjoyment ratings of those in the single-event condition did not differ depending on which of the three events supposedly kept drawing their attention, $F < 1$.

Logically, it stands to reason that a mind that wanders to all sorts of alternatives must have a problem with the focal activity, whereas one that wanders to just one alternative may simply find something about that alternative particularly captivating. Consistent with this logic, participants assumed that they must have had a worse time at a movie to the extent that their mind kept going to a variety of alternative activities. Furthermore, people called on this attributional logic spontaneously, without it being triggered by explicit inference measures that might artificially lead them to engage in it. Of course, these results do not indicate that it is necessary that mindwandering be diffuse for people to conclude that it reflects their boredom with the focal activity.

They merely indicate that such an inference is enhanced when it is.

Study 4

Thus far we have shown that three variables—positivity, concurrence, and diffuseness—influence the inferences people make about what their mindwandering says about their enjoyment of an ongoing activity. In Study 4, we again examined one of these moderators (concurrence) but also highlighted for some participants that their mindwandering may have been influenced by an experimental manipulation (and thus did not reflect their enjoyment of the focal activity). Using a variant of the priming task from Study 1, we first asked participants to write about either the enjoyable activities they would have been doing had they not been in the lab or the enjoyable things they tended to do on a typical afternoon in high school. We relied on our finding from Study 1 that such a priming task would influence the content of participants' mindwandering while they worked on the focal task (a crossword puzzle).

To manipulate the perceived diagnosticity of participants' mindwandering, we told half of the participants that we would be testing their memory for what they wrote about and that they should therefore think about what they wrote about while working on the puzzle. By making salient to these participants "external contingencies . . . sufficient to account for" their mindwandering, participants were expected "not to [use] the behavior as a source of evidence" (Bem, 1972, p. 19). Thus, we expected participants to conclude that they did not much like doing the crossword puzzle *only* when: (a) they had been led to think of concurrent positive activities they could have been doing instead, and (b) it had not been highlighted for them why their mind wandered to such thoughts. We expected enjoyment of the crossword puzzle activity to remain high in the other three conditions.

Method

Participants and design. Fifty-five Cornell University undergraduates were randomly assigned to one of four conditions in a 2 (mindwandering: concurrent or past) × 2 (explanation for mindwandering: yes or no) factorial design.

Procedure. When participants signed up for the study, they were directed to a website where they completed a questionnaire that asked them how much they typically enjoyed different activities from 1 (*do not enjoy at all*) to 5 (*enjoy very much*). Embedded in this list was "crossword puzzles."

The cover story was similar to the one used in Study 1. For the first task, half of the participants were asked to write about enjoyable things they would have been doing had they not been in the lab at that time (concurrent mindwandering condition, as in Study 1). The other half were asked to write about how they would have enjoyed themselves during a random weekday afternoon in high school (past mindwandering condition). We again asked participants to provide rich and detailed descriptions, prompting them with specific questions.

The experimenter then explained that the in-lab experience assigned to them was a crossword puzzle. Participants were told that the experimenter would leave the room for 15 min to give them a chance to work on a puzzle from a major newspaper. At this point, participants in the explanation-for-mindwandering condition were provided with a reason for why they might continue to think about the activities they had just described. The experimenter told these participants that at the end of the study, they would need to provide a description of what they wrote about in the first part, so they should "try to keep those details in mind as you work on the puzzle."

After participants had worked on the puzzle for 15 min, the experimenter returned and collected the puzzle. To reinforce the explanation-for-mindwandering manipulation, these participants were asked whether they had trouble keeping the information in mind while working on the puzzle. At this point, all participants indicated how much they enjoyed working on the puzzle, how engaged they were with the puzzle, how likely they were to want to complete a crossword puzzle again in the future, and how pleased they were that the task randomly assigned to them had been the crossword puzzle. Participants indicated their responses on scales ranging from 1 (*not at all*) to 11 (*completely*). We standardized and averaged the four items to create a single enjoyment composite with high internal reliability ($\alpha = .90$).

Finally, participants rated how often their minds tended to wander to thoughts of doing other things on a scale ranging from 1 (*almost never*) to 11 (*all the time*).

Results and Discussion

We hypothesized that only when mindwandering was focused on concurrent activities, and only when participants did not have a ready explanation for why they were preoccupied with such thoughts, would enjoyment of the focal task be diminished. A preliminary one-way ANCOVA of the enjoyment composite, controlling for pretest ratings of crossword puzzle enjoyment, revealed that enjoyment varied by condition, $F(3, 51) = 3.00$, $p = .04$. We then tested our hypothesized pattern of results with a contrast that compared the responses of participants in the concurrent/no-explanation condition (–3) with those of participants in the concurrent/explanation (+1), past/no-explanation (+1), and past/explanation (+1) conditions. This yielded the predicted significant effect, $t(51) = 2.76$, $p = .01$ (see Figure 2).

To explore this pattern further, we compared the concurrent/no-explanation condition separately with each of the others. Those in the concurrent/no-explanation condition enjoyed the puzzle less than those in the concurrent/explanation condition,

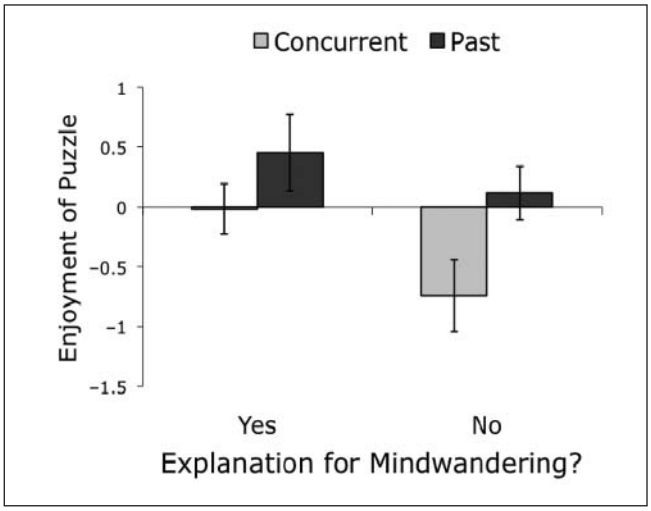

Figure 2. Enjoyment of the puzzle as a function of the mindwandering manipulation and whether participants had a ready explanation for what they were thinking about (Study 4)
The reported means control for baseline puzzle enjoyment.

$t(51) = 2.30$, $p = .03$; those in the past/explanation condition ($M = .46$, $SD = 1.11$), $t(51) = 2.92$, $p = .01$; and marginally less than those in the past/no-explanation condition, $t(51) = 1.83$, $p = .07$. Comparisons between the three conditions not hypothesized to show an enjoyment decrement were all nonsignificant, ts < 1.26, ps > .21.

One might wonder whether the attribution manipulation, as intended, only diminished the perceived informativeness of participants' mindwandering, or whether it also artificially increased the amount of mindwandering, which in turn may have imposed a cognitive load on participants. Further analysis revealed that the manipulation did not influence the frequency with which people's minds wandered, Fs < 1.21, ps > .27. And although memory manipulations can certainly impose a cognitive load, they do so by making it necessary for participants to continually rehearse the to-be-remembered information (e.g., a random string of characters). In this case, given the very limited information participants were called on to remember, and given that the explanation manipulation did not lead people to think more about non-task-related activities, it is unlikely that much rehearsal was required. Nevertheless, to test directly whether participants' cognitive resources were more taxed in the explanation condition, we examined participants' performance on the crossword puzzle. Directly countering the cognitive load explanation, a one-way ANCOVA (controlling for baseline puzzle enjoyment) revealed that those in the explanation condition actually completed more of the puzzle ($M = 6.12$ solutions) than those in the no-explanation condition ($M = 4.62$ solutions), $F(1, 50) = 7.64$, $p = .01$. Given that the explanation instructions did not lead to diminished performance, it is unlikely that they imposed much cognitive load. Importantly, controlling for the between-condition differences in performance, the focal 3 versus 1 contrast remained significant, $t(49) = 2.43$, $p = .02$.

Study 4 thus extends the results of the previous studies by demonstrating that reported enjoyment of a task can be influenced by the content of participants' mindwandering, but only when an alternative attribution for the mindwandering is not readily available. Study 2 had demonstrated that people infer that mindwandering to enjoyable concurrent activities is more diagnostic of boredom with a focal task than thinking about past activities. The results of Study 4 demonstrate that such inferences apply: (a) toward actual focal activities, not simply those considered in a hypothetical a scenario, and (b) without prompting by any explicit inference measures that might elicit an attribution process that would not have occurred otherwise. Furthermore, this study further rules out the alternative explanation that positive mindwandering makes one's current experience seem less enjoyable by simple contrast. Any artifactual explanation involving simple contrast cannot account for the observed effect of the attribution manipulation.

General Discussion

Self-perception theory posits that our internal cues are not easily distinguished or verbalized, and so we often must make judgments of our own feelings, preferences, and beliefs much as an outsider would (Bem, 1972). Although we may indeed have surprisingly little direct access to attitudes and beliefs, this research focuses on one internal cue that we can all readily identify and that we use to make sense of what we like and what we do not—the content of our wandering minds. When inferring our own preferences, we attend not only to whether our overt, external behavior is freely chosen; we look as well to a type of covert, internal cue—mindwandering.

In determining whether to rely on a given cue—external behavior or mental activity—in understanding their own preferences, individuals must determine whether the cue in question is informative: Does it signal something about my preferences, or is it simply a product of some uninformative, external source? We identified three properties of the content of mindwandering that make it more likely to be attributed to boredom with an ongoing focal activity: positivity, concurrence, and diffuseness. Mindwandering to enjoyable activities is seen as more diagnostic of one's present level of satisfaction, promoting the inference that one is currently bored and in need of stimulation. Furthermore, when these imagined positive events are occurring concurrently, people believe it signals their desire to exchange their boring environs for the excitement of what they are imagining. In contrast, when the imagined positive activities occurred in the past, people assume it must be something about that particular past memory (as opposed to many others one could be imagining) that is attention grabbing. By the same logic,

diffuse mindwandering is more likely to be attributed to one's present boredom than mindwandering that keeps returning to a single, attractive alternative. A final study found that experimentally manipulated mindwandering no longer influenced reported enjoyment of a focal activity once participants were focused on the true cause of their mindwandering (the manipulation itself).

Consistent with a self-perception account, and consistent with the methods used in the earliest examinations of the theory (e.g., Bem, 1965), we find that people draw inferences about the meaning of hypothetical mindwandering episodes the same as they do during actual mindwandering experiences. Participants' responses to hypothetical scenarios support the contention that people reason about mindwandering in the predicted fashion, and the studies involving real mindwandering episodes confirm that such processes emerge during actual experience. Studies 1 and 2 demonstrated that people are likely to reason according to the dictates of our proposed logic in both a real situation (Study 1) and a hypothetical scenario (Study 2). Importantly, Studies 3 and 4 found that mindwandering influences perceived enjoyment in the absence of intervening attribution measures that might artificially prompt the attribution process on which the self-perception account relies. The effects on enjoyment were also observed in both a hypothetical scenario (Study 3) and a real situation (Study 4).

Either by measuring participants' attributions for mindwandering or manipulating purported mindwandering in a hypothetical scenario, one necessarily draws participants' attention to the fact that mindwandering has occurred. Is there evidence, then, that people draw conclusions from their mindwandering even when their attention has not been drawn to it? In Study 4, we did not mention mindwandering at all until after participants had completed the task-enjoyment measures. Thus, it appears that people spontaneously rely on (and, when appropriate, spontaneously discount) mindwandering as a cue to task satisfaction.

It is noteworthy that our effects emerged even during fairly involving experiences. That is, participants drew inferences about the meaning of their idle thoughts while they watched a television show (pilot study), worked on a jigsaw puzzle (Study 1), and completed a crossword puzzle (Study 4). This lends credence to the idea that the present findings generalize to the inferences people draw about mindwandering as it plays out in rich, everyday, real-world experience.

Given currently available methods, we do not have the ability to manipulate the content of participants' mindwandering with great precision. In Studies 1 and 4, we relied on a crude methodology—a supposedly unrelated writing task designed to influence participants' subsequent thoughts. Of course, some participants may have recognized that what they were thinking about was not a reflection of boredom but a result of the experimental manipulation. But this only works against our hypotheses, making any such participants less likely to conclude that they were dissatisfied with the target activity. In fact, the success of the attribution manipulation in Study 4 depended on control participants' not spontaneously drawing the connection between the writing task and their mindwandering. As Bem (1972) noted, many self-perception effects reported in the social psychological literature depend on participants being unaware that the critical experimental manipulation has had an influence on their behavior.

Although we have found that people are more likely to assume that they are bored with an ongoing activity if their minds wander to exciting rather than dull activities, might there be occasions in which the opposite pattern holds? That is, might people sometimes conclude, implicitly or explicitly, that "if I can't even keep my mind from straying to something as dull as this, I must *really* be bored with what I'm doing"? That is a question for future research, but we would speculate that people are most likely to assume boredom from positive mindwandering when, as we have shown here, their minds wander to a diverse set of alternative activities rather than a single alternative and when their minds wander to activities they could be pursuing at the moment rather than activities from the distant past. Also, some positive activities may be so manifestly potent in their pull that they do not lead to an inference of boredom with a current activity. For instance, when one's mind wanders to an imminent reunion with one's partner after weeks apart, the fact that it is hard to concentrate on the task at hand is not taken as a sign of dissatisfaction with that task. Of course, our data suggest that both possibilities are more the exception than the rule, and future research should help refine our understanding of what intuitive theories people are most likely to apply, and in what circumstances, in making sense of their mindwandering.

Although we have suggested a cognitive, inferential account of how mindwandering influences people's attitudes about an ongoing target activity, is it possible to explain our results by more affective processes? This seems unlikely for several reasons. First, it would be hard for an affective account to explain the results of the scenario studies, which are unlikely to generate much affect. Second, the most plausible affective account would most likely lead to results that are the exact opposite of what we observed in our studies. By a simple affective account, thinking of positive activities should put one in a better mood, which should make people think of the target activity more favorably, not less. Finally, the success of the attribution manipulation in Study 4 casts doubt on any sort of mood-based account and provides strong support for the information-processing account we have proposed.

Of course, it is not just with respect to mindwandering that largely random thoughts can be granted significance. Morewedge and Norton (2009) have demonstrated that people ascribe meaning to the content of their dreams, despite the fact that dreams are often nothing more than the result of attempts to interpret random impulses from the pons (Muzur, Pace-Schott, & Hobson, 2002). In one study, participants

indicated that they would be more likely to cancel their air-travel plans following a dream in which their flight crashes than following a government-issued terrorism warning. But there is a basic difference in the inferences people draw from daydreaming and dreams they have at night. Morewedge and Norton report that people ascribe significance to the specific content of their dreams, with meaning accorded to the extent that the content of a dream cannot be attributed to a specific source. Thus, one ignores the significance of a dream about a fire alarm once it becomes clear that a real-life alarm has been blaring and that it was that real-world fact that was responsible for the dream. In contrast, we did not find that people ascribe special significance to the exact content of mindwandering (see Study 2) but rather used various abstract features of the content of their daydreams to make inferences about why they were engaging in mindwandering at all. In short, the mere fact that one has dreamed during sleep is not taken as significant, but the specific content of the dream is. With mindwandering, in contrast, it is a set of specifiable abstract features of the content of one's idle thoughts—abstract features consistent with basic attributional principles—that is significant, not the detailed content of the daydream or the very fact that one is daydreaming.

In the boredom literature, researchers have differentiated between situation-dependent and situation-independent boredom (Neu, 1998; Todman, 2003). Situation-dependent and situation-independent boredom are produced by bland or tiresome aspects of the situation and dispositional tendencies of the person, respectively. Mindwandering that cues inferences of boredom likely results from both situation-dependent and situation-independent causes, as well. For example, one may have stayed home with one's partner to watch a primetime TV lineup, only to find that a sports commercial sparked mindwandering to a baseball game one might have attended. To the extent that the true cause (e.g., the advertisement) of one's mindwandering is not fully appreciated, one may infer dissatisfaction with the evening as a result of this situation-inspired mindwandering.

On the dispositional end, some individuals may be more likely to ruminate about unselected alternatives and thus infer dissatisfaction with what they chose. For example, Iyengar, Wells, and Schwartz (2006) found that job-seeking college seniors who were maximizers—those who exhaustively search choice options to make the best choice (Simon, 1956)—were more likely to fixate on nonchosen alternatives and to fantasize about unrealized alternatives. Consistent with our research, Iyengar et al. found that such counterfactual thoughts—a particular type of mindwandering—mediated maximizers' greater negative affect once their job search had concluded. Continued thought about unrealized alternatives did not result from maximizers' attaining less desirable jobs—in fact, they accepted more attractive jobs. Instead, the continued consideration of other jobs appears to have led maximizers to conclude that they were not satisfied with their chosen positions.

The present research reinforces the basic principle of self-perception theory that the same attributional logic we use to make inferences about others' preferences is used to understand our own. Having emerged from a behaviorist tradition, self-perception theory downplays the significance of internal cues and posits that we must look outside of ourselves—much as observers do—to make sense of our attitudes and beliefs. Although external cues may generally be more distinct and more readily interpretable than internal cues, the present expansion of self-perception theory maintains that some internal cues, such as the awareness that one's mind keeps wandering, are readily available and interpretable, and therefore play an important role in the inferences people make about their own attitudes and preferences. In this spirit, Bem (1972) conceded that there were no doubt certain advantages of having access to internal cues. Presciently, Bem observed that only the insider can detect his or her own mental effort, an observation that presaged the vast literature on fluency (Alter & Oppenheimer, 2009). We hope that the present research will prompt interest in another of these informative, internal cues—mindwandering.

Acknowledgments

We thank Erik Helzer for his comments on an earlier draft of the manuscript. We thank Kamali Bent, Justin Landy, Brian Mayer, Katie McCrary, Linda Mohammadian, Sarah Mayefsky, Ethan Russell, Caroline Sheehan, and Muxin Yu for their assistance with data collection.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research and/or authorship of this article: National Science Foundation (NSF) Graduate Research Fellowship awarded to Clayton Critcher, and NSF Grants SES0542486 and SES0922323 awarded to Thomas Gilovich.

Notes

1. For this subsidiary analysis, we used the manipulation check of mindwandering valence, instead of the dichotomous condition assignment, given the greater statistical power that comes from the more sensitive continuous measure. Further encouraging use of the continuous measure, the distributions of the manipulation check for each condition are highly overlapping: For example, 33.6% of participants in the positive mindwandering condition reported equally negative or more negative mindwandering than the median participant in the negative mindwandering condition.
2. The correlation between the first two items ($r = .45$, $p < .001$) confirms, as in Study 1, that when mindwandering is taken as a "signal to how satisfied one is," it is (of course) taken as a signal of *dis*satisfaction.

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