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Chapter 10

Zoning Out while Reading: Evidence for Dissociations between Experience and Metaconsciousness

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As you begin this chapter, you are probably paying at least some attention to the words you are reading. After a page or two, however, there is a real possibility if not likelihood, that your attention may wander. Should that happen, your eyes may continue moving across the page, the phonology of the words may continue sounding in your head, yet your mind will be elsewhere. This phenomenon of "zoning out" while reading is ubiquitous. Whenever we ask people about it, their response is almost invariably the same: a sheepish grin and the confession "Well, yes, this happens all the time." Although all too common in its occurrence, scientific discussions of the phenomenon of zoning out while reading have been markedly lacking. This oversight is notable for several reasons. From a pragmatic perspective, if people zone out as frequently as informal anecdotes suggest, then we may have overlooked a potentially important reason for reading failures. If one reads without devoting any attention to the text, then it stands to reason that one's comprehension will be compromised. Equally important, however, are the metacognitive implications of zoning out while reading. If, as seems likely, people understand that zoning out is inherently incompatible with successful reading, then their reports of zoning out while reading suggest that people can fundamentally lack an awareness of the contents of their consciousness.

The disassociation between the experience of zoning out while reading and the awareness that one has been zoning out illustrates the value of distinguishing between experiential consciousness, corresponding to the contents of experience, and what we alternatively refer to as "metaconsciousness" or "meta-awareness"¹ (Schooler, 2001, 2002; Schooler, Ariely, and Loewenstein, 2003), corresponding to one's explicit awareness of the contents of consciousness. Accordingly, when people zone out, they are experientially conscious of whatever topic has grabbed their attention, while at the same time lacking metaconsciousness of the fact that they are zoning out. At some point during the reading episode, they suddenly become metaconscious that they have been zoning out and realize that for some time they have been reading without comprehension. In a recent analysis of possible dissociations between consciousness and metaconsciousness, Schooler (2002) refers to such consciousness in the absence of metaconsciousness as a "temporal dissociation." There are many cases where the application of metaconsciousness

to the experience may actually interfere with the experience itself, that is, where temporal dissociations between consciousness and metaconsciousness may actually be adaptive, as, for example, when one is in a "flow" state (Csikszentmihalyi, 1990) of deep concentration or when one is engaging in automatic (Baumeister, 1984) or intuitive (Schooler, Ohlsson, and Brooks, 1993; Wilson and Schooler, 1991) processes. Yet there are other cases in which the absence of metaconsciousness can pose a problem. The failure to notice that one's mental reveries have curtailed one's comprehension during reading is a case in point.

In this chapter, we consider how a distinction between experiential consciousness and metaconsciousness can help both to characterize and to explain zoning out during reading. We begin by reviewing two surprisingly scant lines of previous empirical research relevant to zoning out while reading: educational research on comprehension monitoring and cognitive research (both laboratory and clinical) on task-unrelated images and thoughts. Although the findings of both these lines of research have important implications for the phenomenon of zoning out while reading, their oversight in not addressing zoning out directly has gone largely unnoticed. We correct this oversight by describing two recent experiments we conducted to explore the frequency, awareness, and comprehension implications of zoning out while reading. We conclude by considering the implications of our findings for theories of visual ocular motor control associated with reading specifically, and for theoretical conceptualizations of mindless behaviors more generally.

Previous Research Relevant to Zoning Out while Reading

Given the intimate familiarity that most people have with the experience of catching themselves zoning out while reading, it is rather remarkable that so little research has addressed this phenomenon. There are, however, two general lines of research that are clearly relevant. In the domain of reading, there is a large literature on what has variously been referred to as "comprehension monitoring" (e.g., Brown, 1980), "metacomprehension" (e.g., Maki and Berry, 1984), or "self-regulated comprehension" (e.g., Hacker, 1998). This work, although overlooking the possibility that people can fail to notice that they are not attending to the text at all, demonstrates the importance of metacognitive monitoring strategies in the maximization of reading performance. A second relevant literature, on what has somewhat awkwardly been referred to as "task-unrelated images and thoughts" (TUITs; see Giambra, 1995; Singer, 1993, for reviews), has devoted substantial attention to situations in which people's minds wander from the task on which performance is being measured. With several important exceptions, however, this research has explored TUITs associated with nondemanding tasks for which successful performance is not undermined by following an unrelated train of thought. This research thus provides relatively little insight into either the costs of mind wandering or the cases where people may not realize that their minds have

wandered. In the following section, we briefly review the respective literatures on comprehension monitoring and on TUTIs as these may pertain to the largely unstudied topic of zoning out while reading.

Comprehension Monitoring

In recent years, both researchers and educators have increasingly come to appreciate the importance of comprehension monitoring for successful comprehension performance, that readers who attend to how well they understand what they are reading can better repair misunderstandings than readers who do not. Two general approaches have been devoted to exploring comprehension monitoring: training studies, where readers are taught techniques to increase their comprehension monitoring, and assessment studies, where readers' monitoring performance is assessed and related to their comprehension performance.

Training Comprehension Monitoring Numerous successful reading enhancement programs have been developed on the premise that encouraging comprehension monitoring will enhance performance. This basic thesis represents the backbone of Palincsar and Brown's "reciprocal teaching" approach (1984), in which the metacognitive monitoring of comprehension is encouraged by engaging students in a dialogue with teachers on applying the four reading comprehension strategies of summarizing, question generating, clarifying, and predicting. Students involved in this training approach become increasingly adept at using these strategies and show significant improvement in their reading comprehension. A similar type of reading enhancement program that also emphasizes the importance of metacognitive monitoring of comprehension, Brown and Pressley's "transactional strategies instruction" (1994), trains students in the use of strategies such as question generating, clarifying, and so on, and engages them in didactic interactions with teachers to enhance the use of these skills. Like reciprocal teaching, transactional strategies instruction has been shown to enhance the effective use of self-regulated strategies (as revealed by think-aloud protocols) and to improve reading comprehension performance (as measured by standardized tests).

The finding that reading comprehension is facilitated by training students to use strategies that enhance comprehension monitoring is consistent with the hypothesis that the metacognitive lapse of zoning out while reading may undermine reading performance. Clearly, readers cannot zone out if and while they are actively engaging in strategies (such as question generating and clarifying) that require comprehension monitoring. Nevertheless, not only have discussions of why strategy use may be effective in enhancing reading comprehension failed to address this metacognitive lapse; many of the techniques used to assess strategy use (e.g., think-aloud protocols) require readers to be "on task." In short, although comprehension-monitoring training may reduce the frequency of zoning out, the types of monitoring failures explicitly envisioned by such programs involve lapses

in how deeply readers are thinking about the text, rather than in whether they are thinking about the text at all.

Assessing Comprehension Monitoring Another approach for establishing the relationship between comprehension monitoring and performance has been, first, to identify dependent measures of comprehension monitoring and, then, to examine their relationship to reading performance. Two general methodologies have been explored: error detection (e.g., Glenberg, Wilkinson, and Epstein, 1982), where participants must detect inconsistencies embedded in text, and comprehension prediction (e.g., Maki and Berry, 1984), where participants read text passages and attempt to predict how well they will perform on a subsequent reading comprehension test. Strikingly, although both purportedly measure the same thing, these two approaches have diverged in their ability to distinguish more versus less successful readers. One possible reason for this divergence is that the two approaches may be differentially sensitive to zoning out.

Research on comprehension prediction has been rather unsuccessful in documenting a clear relationship between comprehension monitoring and performance. In several of the original investigations, readers were found to be at chance in predicting how well they would perform on a subsequent reading comprehension text (e.g., Glenberg and Epstein, 1985). More recent studies (e.g., Maki, 1995) have found that if readers are given a sufficient number of test questions per prediction, then they perform better than chance in their predictions (presumably because this method provides a more sensitive measure). Nevertheless, even when readers are found to be above chance at predicting their comprehension performance, the relationship between readers' skill in making predictions and their reading performance has proved quite equivocal. Although some studies (Glover, 1989; Maki and Berry, 1984) found a strong positive relationship, others have found no relationship (Glenberg and Epstein, 1985; Lovelace, 1984; Maki, Jonas, and Kallod, 1994), and at least one found a negative relationship (Gillstrom and Ronnberg, 1995). One potential reason why prediction studies have failed to find a relationship may be that the prediction activity encourages a level of monitoring that is sufficient to prevent a key type of monitoring lapse (i.e., zoning out). In other words, individual difference measures that require one to attend to the text in order to assess monitoring skill may fail to identify individuals whose monitoring difficulties involve periodically failing to attend to the text altogether.

Research on error detection has been somewhat more successful in documenting a relationship between monitoring performance and comprehension. Studies examining participants' ability to catch inconsistencies in text typically have found that good readers are more likely than poor readers to detect textual inconsistencies (e.g., Garner and Kraus, 1981-82; Garner and Reis, 1981). One of the enigmatic findings in this literature, however, is that even good readers show a surprisingly high capacity to miss textual incoherencies (e.g., Glenberg,

Wilkinson, and Epstein, 1982). In fact, the suggestion that all readers—both good and poor—are occasionally susceptible to zoning out may help to explain this finding, for even the best readers will have difficulty detecting text inconsistencies when they are zoning out. The suggestion that error detection may be sensitive to zoning-out episodes may also help to explain why comprehension-monitoring performance is predictive of reading ability when assessed by error detection measures but not when assessed by comprehension prediction measures. Accordingly, if zoning out is a fundamental type of comprehension-monitoring failure, then measures that are sensitive to zoning out should be more predictive of comprehension performance than measures that are not.

Task-Unrelated Images and Thoughts

Arguably, the research most directly relevant to the general topic of zoning out while reading is that on task-unrelated images and thoughts (TUITs). Pioneered by Jerome Singer (e.g., 1978), John Antrobus (e.g., Antrobus et al., 1970), and more recently pursued by Leonard Giambra (e.g., 1995), this line of research has sought to explore the nature and causes of daydreaming. In the majority of studies on this topic, participants are given a dull vigilance task and are asked to report every time they experience a task-unrelated thought. Over the years, considerable knowledge has been gained regarding the circumstances under which TUITs are most likely to occur. For example, TUITs are particularly likely to happen when individuals are stressed (e.g., Antrobus, Coleman, and Singer, 1967), when the experimenter and participant are of opposite sex (Singer, 1988), when a participant's circadian rhythm is at a relatively high level of arousal (Giambra et al., 1988), or when the task is less demanding (Giambra and Grodsky, 1989). Additional studies have demonstrated reliable individual differences in people who are more versus less likely to experience TUITs. For example, TUIT occurrence tends to be positively correlated with the self-reported frequency of daydreaming (Antrobus, Coleman and Singer, 1967) and with a prior history of attention deficit disorder (Shaw and Giambra, 1993), whereas it tends to be negatively correlated with age (Giambra, 1989).

Generalizing conclusions, however clearly pertinent, from the literature on task-unrelated images and thoughts to the domain of zoning out while reading is complicated because the vast majority of studies have used inherently dull and nondemanding vigilance tasks for which successful performance does not require participants' undivided attention. Given that such tasks are apt to encourage participants to knowingly think about unrelated topics (to "tune out"), much of the research on TUITs cannot speak to the situations in which counterproductive mind-wandering episodes may initially proceed unnoticed.

Although the vast majority of studies on task-unrelated images and thoughts have involved nondemanding tasks, two rarely cited studies (Giambra and Grodsky, 1989; Grodsky and Giambra, 1991) examined the incidence of TUITs in the more demanding task of reading; moreover, they did so by training

participants to differentiate between intentional TUTs (i.e., deliberately thinking about something unrelated to the text) and unintentional TUTs (i.e., unintentionally thinking about unrelated thoughts). In Giambra and Grodsky, 1989, participants were required to read multiple passages of text that varied with respect to both interest and difficulty and to report, using a computer response key, every time they experienced a TUT, whether intentional or unintentional. Even though successful reading would seem to be incompatible with TUT generation, Giambra and Grodsky, 1989, found that successful readers regularly reported both intentional and unintentional TUTs. It also found that attentional demands were unrelated to TUT frequency: difficult text was no less likely than easy text to produce TUTs. Not surprisingly, however, dull text was more likely than easy text to lead to TUTs. Using a similar paradigm, Grodsky and Giambra, 1991, replicated these results and found that TUT frequency on a reading task was correlated with TUT frequency on a vigilance task.

The Giambra and Grodsky, 1989, findings on task-unrelated images and thoughts—particularly unintentional ones—while reading are consistent with anecdotal reports that people can zone out while reading without initially noticing it. However, strong conclusions regarding the occurrence of unaware zoning out and its impact on reading performance are limited for various reasons. First, Giambra and Grodsky, 1989, focused on individuals' intention to engage in TUTs rather than on their awareness that they were engaging in TUTs. Although potentially related, there are distinct differences between the intention to do something and the awareness that one is doing something. It is quite plausible that individuals might not intend to think about an unrelated thought, and yet nevertheless immediately notice when they do so. By way of analogy, just because people do not intend to slip does not mean they are not immediately aware of slipping. That individuals reported unintentionally engaging in TUTs thus does not necessarily imply that they were unaware of doing so. Second, people are actually quite poor at assessing their own intentionality, and have been shown to freely take responsibility for initiating actions they could not possibly have intended to undertake (Wegner and Wheatley, 1999). Such findings raise important questions about whether people can effectively discriminate between intentional and unintentional thoughts. A final, and most important, limitation of earlier research on TUTs while reading is that it did not explore the relationship between TUT occurrence and reading performance. Though consistent with the premise that people may regularly fail to notice that they are zoning out while reading, the work on TUTs and reading allows us neither to know whether such lapses can go undetected nor to assess the potential impact they may have on reading comprehension.

Recent Research on Zoning Out while Reading: A New Paradigm

To correct the oversight of the two lines of previous relevant research, we (Schooler, Reichle, and Halpern, in preparation) developed a new paradigm

specifically designed to explore people's awareness of zoning out while reading and the impact of zoning out on reading performance, and we employed that paradigm in two experiments. The paradigm required participants to read what was for many of them a rather dull text (the opening chapters of *War and Peace*) on a computer screen and to indicate with a keypress every time they caught themselves zoning out. The experience of zoning out was defined as a situation in which readers realized they had "no idea what [they] just read" and that they were "not really thinking about the text, but . . . of something else altogether." Consistent with our anecdotal experiences, participants readily understood the concept of zoning out and typically reported that they were intimately familiar with the phenomenon.

Experiment 1 Our first experiment included 45 participants and involved a 2×2 between-subjects design with two variables (1) whether participants received the intermittent zone-out experience-sampling probe; (2) whether the text was presented paragraph by paragraph or page by page. Both variables were included in order to assess the robustness of the procedure to modest task variations. Because neither the introduction of the experience-sampling probes nor the text presentation format had any significant effects on either zoning out or reading comprehension performance, the data reported are collapsed across these variables.

Two separate innovations were introduced in order to explore the hypothesis that individuals can zone out without (at least initially) realizing that they are doing so. First, each time participants reported zoning out, they were simply asked to respond to the question "Were you aware that you were zoning out while you were zoning out?" Second, half of the participants were intermittently probed regarding whether, at that particular moment, they had been zoning out. This experience-sampling procedure (e.g., Hurlburt, 1993) occurred 2-4 min after the initiation of the experiment and then occurred every 2-4 min following a previous zone-out report or probe. We reasoned that if we could catch participants zoning out before they caught themselves, then this would provide evidence that they had not realized that they were in fact zoning out before the probe.

Finally, in order to examine the relationship between zoning out and reading comprehension, we included a forced-choice comprehension test at the end of the experiment. If zoning out represents a form of comprehension-monitoring failure that impacts reading ability, then we should find a relationship between the frequency of zoning out and comprehension performance.

The results of our first experiment demonstrated that it is readily possible to observe zoning out during reading in a controlled laboratory context. On average, participants caught themselves zoning out approximately 5.4 times during the 45 min reading period. Several findings were consistent with the hypothesis that people are often (at least initially) unaware of the fact that they are zoning out. On approximately 67% of zone-out responses, participants specifically indicated

they believed they had not been aware that they were zoning out while they were zoning out. In addition, the probe procedure was successfully able to catch people zoning out before they had caught themselves. On average, participants were caught zoning out by the probe 1.6 times per session. Although this may seem like a relatively modest frequency, it is important to note that the participants were only probed on average 6 times per session. Thus the most useful way to conceptualize the probe measure is in terms of the proportion of zone-out probes that actually caught the participants zoning out. This measure, or probe-catch ratio, indicated that nearly 13.2% of the time participants were zoning out, without being sufficiently aware of it to report it.

Analysis of individuals' characterizations of their zoning-out episodes indicated that they were only very rarely (less than 3% of the time) thinking about what they were reading when they reported zoning out. Although they sometimes reported thinking about nothing at all (18%), more often participants reported thinking about specific things, such as school-related topics (27%), fantasies (19%), and themselves (11%). In short, although participants were often unaware of the fact that they were zoning out, their minds were nevertheless being occupied by rich thoughts that were completely unrelated to what they were reading.

A key issue in assessing the importance of readers' zoning-out responses is whether they are predictive of actual reading performance. Although, in this experiment, the frequency of self-caught zone-outs was unrelated to comprehension performance ($r = .07$; n.s.), the probe-catch ratio (i.e., the proportion of probes that caught individuals zoning out) was highly correlated with subsequent recognition performance ($r = -.55$, $p < .05$). This finding suggests that the tendency to zone out without noticing it may be a key source of reading error.

In sum, our first experiment demonstrated that it is relatively easy to catch participants zoning out while reading in a laboratory experiment. Analysis of participants' characterizations of their zone-outs was consistent with the claim that zoning out typically involves thinking about unrelated topics without initially noticing that one is doing so. Additional evidence that readers often fail to notice that they are zoning out comes from the experience-sampling condition in which 13% of the time participants were caught zoning out by the probes before they had caught themselves.

Experiment 2

Although clearly encouraging, one reasonable question about the results of our first experiment arises: How do we know that participants were genuinely zoning out when they reported doing so? One source of evidence that participants were in fact being factual in their reports is the correlation between zoning out and final recognition performance. Given that this result was merely correlational, however, it is possible that other factors (e.g., being low in motivation) may have contributed to both reports of zoning out and poor reading comprehension performance. This concern is particularly salient in that we only observed the correlation

between comprehension and zoning out with the experience-sampling measure. Accordingly, it is quite plausible that unmotivated subjects may have both read carelessly and almost never spontaneously reported catching themselves zoning out. Nevertheless, when directly confronted by a probe, these same participants may have characterized their general low involvement by indicating that they were zoning out. Therefore, to more directly validate that participants really are not attending to the text when they report zoning out, it was important to get a more on-line measure of comprehension. Experiment 2 addressed this issue by following every report of zoning out with a text recognition question that queried participants about what they had just been reading. As a baseline control, other participants were randomly probed about the text material without being asked if they had been zoning out. If individuals who report zoning out are genuinely not attending to the text at the time they report zoning out, then their performance on the preceding text should be lower than the baseline performance of participants who are randomly queried with the same questions.

A second potential concern with the procedure introduced in experiment 1 was the potential impact that the various measurements may have had on reading. Although experiment 1 suggested that the inclusion of the intermittent probe measure had no effect on the frequency of self-caught zone-outs, it is quite possible that a reverse effect (i.e., an effect of self-catching zone-outs on the frequency of probe-caught zone-outs) may have occurred. Indeed, having people continuously attend to whether they are zoning out could in principle increase or decrease the incidence of zoning out as revealed by the experience-sampling procedure. Continuously monitoring the occurrence of zoning out might decrease its overall frequency due to increased vigilance. Alternatively, continuous monitoring might increase zoning out because monitoring for unwanted thoughts can—under some situations—increase the likelihood of their occurrence (Wegner, 1994, 1997). To explore the potential reactivity of the various manipulations used in this paradigm, experiment 2 systematically varied the type of interruptions that participants were given during their reading episodes. The resulting design led to 6 conditions. In condition 1, participants simply read the text in a self-paced fashion, and were not provided with any information regarding zoning out. In condition 2, called "zoning out," as in experiment 1, participants were instructed to indicate whether they were zoning out whenever they received a probe. In condition 3, participants were instructed as in condition 2 but, in addition, were asked to indicate whenever they self-caught themselves zoning out, thereby partially replicating the page-by-page, self- and probe-caught condition of experiment 1. As mentioned, however, conditions 1–3 differed from their counterparts in experiment 1 in that, after reporting a zoning-out episode, participants were given a recognition test corresponding to the text they were reading just before they reported zoning out. To test for the impact of this measurement, conditions 4–6 were identical to conditions 1–3, respectively, except that participants were not required to perform this recognition test.

The results of experiment 2 replicated and extended those of experiment 1. As in experiment 1, participants who were asked to self-catch zoning-out regularly caught themselves with an average of 2.9 self-caught zone-outs per session and participants who were probed regarding whether they were zoning out were once again frequently "caught" zoning out, with an average probe-catch ratio of 23%. Experiment 2 also found that the zoning-out paradigm is robust against minor modifications in the procedure. Neither the text recognition probes nor the introduction of self-monitoring instructions influenced the likelihood that participants were caught zoning out by the probes. That the self-monitoring instructions had no appreciable effect on the frequency of probe-caught zone-outs suggests that attending to zoning out neither increases zoning out due to the increased accessibility of suppressed thoughts (Wegner, 1994, 1997) nor decreases it due to increased vigilance.

Of critical interest in experiment 2 was participants' performance on the text recognition probes. A comparison of text recognition performance on those responses where participants indicated they were zoning out revealed markedly lower comprehension levels than the baseline performance of those participants who were randomly given text recognition probes: .54 versus .78, respectively. This finding provides behavioral evidence consistent with the claim that zoning-out episodes are associated with particularly low levels of attention to the text.

Finally, an analysis of the relationship between zoning out and reading comprehension performance on the final test again revealed that a tendency to zone out is associated with generally reduced levels of comprehension. In experiment 2, the relationship between zoning-out frequency and performance on the final comprehension test was observed both with the probe-catch ratio ($r = -.27$) and with the overall frequency of self-caught zone-outs ($r = -.56$). In addition, a relationship was observed between zoning-out frequency and comprehension, as revealed by overall performance on the intermittent recognition tests. Specifically, we observed negative correlations between the performance on the intermittent recognition tests and both the frequency of self-caught zone-outs ($r = -.42$) and the probe-catch ratio ($r = -.32$).

Although a relationship was found between zoning out and comprehension performance, there was no difference in the comprehension performance of participants who monitored their zoning out versus those who did not, nor was there any effect of the intermittent recognition tests on final performance. These findings suggest that the procedures we used to tap the key reading processes did not themselves disrupt them.

Summary

Two experiments demonstrated the viability of laboratory investigations of zoning out while reading. In addition, these studies provided initial support for the claims that (1) participants genuinely are failing to attend to the text when

they report zoning out; (2) zoning out happens, at least initially, without meta-awareness that it is occurring; and (3) zoning out is associated with overall poor comprehension of the text being read. Evidence that people really were zoning out when they said they were came from both the observed relationship between frequency of zoning out and comprehension performance, and from the finding that the participants' ability to recognize what they had been reading immediately before their zone-out reports was compromised relative to baseline performance. The participants' initial absence of meta-awareness that they had been zoning out was indicated by their self-reports that they were not aware that they were zoning out when they actually were. An absence of meta-awareness of zoning out was also suggested by the fact that the experience-sampling probes frequently caught people zoning out before they had caught themselves. Finally, evidence that zoning out may significantly impact reading performance came from the finding, in both experiments, that the more often participants were found to be zoning out, the worse their overall reading comprehension. Indeed, in experiment 2, the frequency of zoning out was a better predictor of reading comprehension than one of the best standard measures—general vocabulary. Thus a potentially critical, but heretofore overlooked source of reading comprehension failure appears to be the failure of readers to notice they are not attending to the text.

Theoretical Implications of Zoning Out while Reading

There are a number of important implications for the finding that people regularly fail to notice that they are thinking about something completely unrelated to what they are reading. These implications range from very specific potential predictions regarding the nature of eye movement control associated with zoning out, to more general implications about dissociations between experience and meta-consciousness. We consider these topics in turn.

Implications of Zoning Out for Theories of Eye Movement Control

Although the majority of reading research most directly relevant to zoning out while reading, that is, research on comprehension monitoring, has largely overlooked the potential impact of zoning out while reading, the prospect of mindless reading has been anticipated in discussions of the nature of eye movement control during reading. Observing that "most readers have probably had the experience of moving their eyes across text while at the same time their mind wandered so that nothing was comprehended from the text," Rayner and Fischer (1996, p. 746) suggested that this phenomenon would be interesting to study, but that "this 'daydream' mode would be very difficult to study experimentally." Our experiments are one attempt to do so, and thus speak to the question addressed by Rayner and Fischer: What determines when and where the eyes move while reading?

The issue of eye movement control during reading has been the focus of considerable research and debate because the eye-mind link is central to many cognitive activities, including navigating one's environment, driving, and scene perception (to name just a few; see Rayner, 1998, for review). Now that eye-tracking technology has made it possible to measure precisely the eye movements of subjects while they perform a variety of on-line and ecologically valid tasks (e.g., solving math problems; Salvucci, 2001), this information can be used to make inferences about the cognitive processes underlying their task performance. Of course, the validity of this approach depends on there being a link between the eye movements and cognition. Researchers have therefore expended considerable effort to specify the precise nature of this link, building a variety of computational models that—to varying degrees—account for various aspects of the eyes' behavior, particularly in the context of reading text (see Reichle and Rayner, 2002, for review).

Models of eye movement control during reading span a continuum with regards to how the eye-mind link is conceptualized (Reichle, Rayner, and Pollatsek, forthcoming). At one end of this continuum are the oculomotor models, which hold that the moment-to-moment guidance of the eyes through the text is primarily determined by visual and oculomotor constraints (O'Regan, 1990, 1992; Reilly and O'Regan, 1998; Suppes, 1990, 1994; Yang and McConkie, 2001). On the other end of the continuum are the processing models, which assume that eye movements are guided by the immediate demands of linguistic processing (Just and Carpenter, 1980, 1987; Thibadeau, Just, and Carpenter, 1982; Salvucci, 2000). Other models fall somewhere in between these two extremes, for example, in the E-Z Reader model (Reichle et al., 1998; Reichler, Rayner, and Pollatsek, 1999, forthcoming), lexical processing largely determines the timing of eye movements from one word to the next, whereas visual and oculomotor factors determine where within a given word the eyes actually fixate.

At present, there is ample evidence that eye guidance through text is affected by both cognitive variables, such as word frequency (Altarriba, et al., 2001; Inhoff and Rayner, 1986; Schilling, Rayner, and Chumbley, 1998) and noncognitive variables, such as word length (O'Regan, 1979, 1980; Rayner, 1979; Rayner and Morris, 1992). Thus the "either or" nature of the debate about the cognitive determinants of eye movement control has evolved into an effort to better understand the extent to which different cognitive and noncognitive variables affect eye movements during reading. This is exemplified by recent experiments that examined how a parametric manipulation of the demands imposed by linguistic processing affected both the global patterns of eye movement (e.g., fixation duration, skipping rates, etc.) and the local patterns (e.g., fixation locations, the probability of making a refixation as a function of the initial fixation location, etc.) that were observed (Rayner and Fischer, 1996; Vitu et al., 1995). The subjects in these experiments were instructed (1) to read short passages of text; (2) to read short passages of "text" in which all of the upper- and lowercase letters were replaced,

respectively, with upper- and lowercase zs (e.g., "The cat started to . . . became "Zzz zzz zzzzzzz z . . ."); or (3) to scan short passages of text and indicate the presence of pre-specified targets (e.g., the word *zebra*). The results of these studies revealed notable differences in the patterns of eye movements that were observed in each of the three conditions; as one might expect, the immediate effects of linguistic processing (e.g., word frequency effects) that were present in normal reading were absent in the both the z-reading and target-scanning conditions.

On the basis of the aforementioned results, Rayner and Fischer (1996) concluded that the decision about when to move the eyes is primarily determined by ongoing linguistic processing. Unfortunately, as Rayner and Fischer point out, the fact that the subjects (college undergraduates) had many years of reading experience may have allowed them to move their eyes in a manner that approximated the patterns of eye movements that are observed during normal reading. To the extent that this happened, it would minimize any differences between the patterns of eye movements observed in the normal reading and z-reading conditions, and thus fail to provide an adequate estimate of how much the demands of linguistic processing affect the on-line guidance of the eyes during normal reading. As we suggested earlier, the procedure that was used in our two experiments may offer an alternative means by which to explore this issue; the question simply needs to be reframed: What determines when and where the eyes move when a reader (who is supposed to be reading for comprehension) is zoning out? The answer to this question may shed light on the nature of the eye-mind link.

For example, it is conceivable that word identification (being a largely automatic process in highly skilled readers; Rayner and Pollatsek, 1989) proceeds in the absence of conscious effort (i.e., during zoning out), whereas higher-level linguistic processing does not. If this conjecture is true, then lexical-level variables (e.g., word frequency) should continue to influence when the eyes move, whereas higher-level variables (e.g., word predictability) should not. This would lead to frequency effects in the absence of predictability effects whenever readers are attempting to read for comprehension but are zoning out. Furthermore, one might speculate that any eye movements that are observed during zoning-out episodes might closely resemble those that are predicted by one or more of the eye movement models (e.g., E-Z Reader; Reichle et al., 1998; Reichle Rayner and Pollatsek, 1999, forthcoming) if their parameters are adjusted so as to eliminate any effect that word predictability would otherwise have on the rate of lexical processing. Of course, those models of eye movement control that neither allow for the effects of linguistic processing (i.e., oculomotor models) nor allow for dissociations in this processing at different levels (e.g., lexical versus superlexical) should not—at least in principle—be able to account for the patterns of fixation durations that are observed during zoning-out episodes. Thus such data might prove to be extremely useful in evaluating current models of eye movement control. Reichle and colleagues are currently developing an eye-tracking procedure to collect such data.

Implications for the Relationship between Consciousness and Behavior

That readers were regularly caught zoning out without realizing it and that zoning out appears to undermine reading comprehension performance raises a central question: How can one fail to notice what is occupying one's own mind? In the following discussion, we first briefly outline our account of how a distinction between experiential consciousness and metaconsciousness might address this question—central to understanding the phenomenon of zoning out—and then we contrast our account with other theoretical approaches to mindless behavior that might also apply.

The Experiential Consciousness versus Metaconsciousness Distinction In a recent discussion of the potential relationship between metaconsciousness and experience, Schooler (2002) argued that, whereas conscious experience and the tacit monitoring of cognitive activities occur continuously throughout our waking hours, only periodically is attention specifically devoted to assessing the contents of experience (see figure 10.1). Within the context of a theory of metaconsciousness, zoning

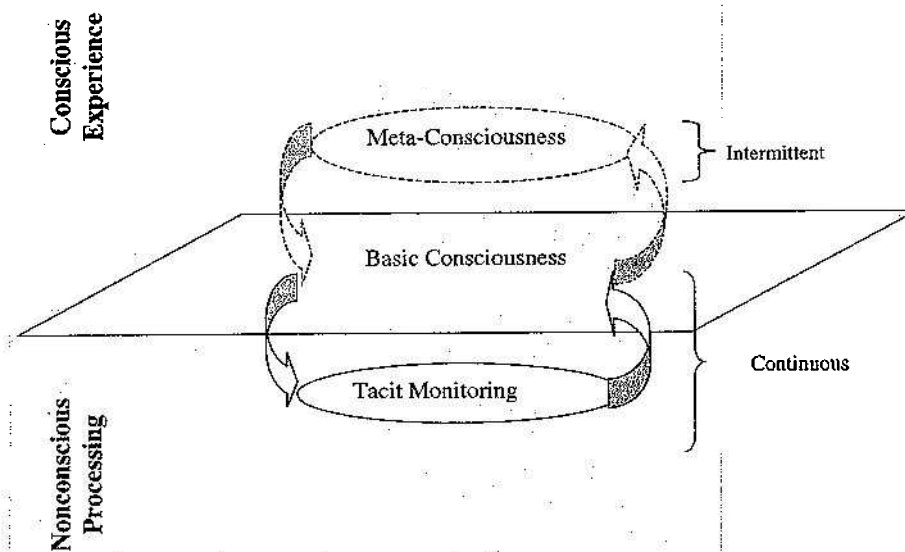


Figure 10.1

Rudimentary characterization of the relationship between metaconsciousness and consciousness. Throughout waking hours individuals continuously experience basic consciousness, including perceptions, feelings, and nonreflective cognition. Basic consciousness is monitored by a tacit system that continuously checks consciousness for certain types of goal failure, unwanted thoughts, and so on. Intermittently, situations arise (e.g., a significant goal failure that requires attention, a strong emotional response, a request to report experience, etc.) in which individuals must explicitly appraise the contents of their experience (metaconsciousness). (After Schooler, 2002)

out can be conceptualized as occurring in those situations where the tacit monitoring system misses a goal failure, so that a correction must await detection by metaconsciousness. Accordingly, as individuals engage in thought, it is likely that they tacitly monitor the coherence of their train of thought, often repairing it seamlessly without even realizing that they have done so. When the mind wanders, however, the tacit monitoring of the conceptual coherence of thought may be thrown off because cognition continues to be coherent. In such situations, the reader is simply not focused on what is being read. Recognizing the fact that one has been zoning-out may therefore require a higher-order form of monitoring (i.e. metaconsciousness) in which one assesses the specific content of thought in relationship to the current goals regarding what one wants to think about. If the intended and actual contents of thought largely overlap, then attention can once again be returned entirely to the train of thought. If, however, a discrepancy arises, then a correction must be initiated. Because metaconscious reflection is resource demanding, it is likely to be curtailed once a correction has been made, thereby setting the stage for another, initially unnoticed, zone-out episode.

Although the above framework is clearly in need of elaboration, it provides a general account of why readers zone out (i.e., their tacit monitoring systems are insensitive to errors of this type) and the process by which zoning out is ultimately caught (i.e., metaconsciousness is eventually directed to the contents of thought). Although simplistic, it is notable that this account provides insights into the phenomenon that seem overlooked by other relevant accounts of mindless behavior.

Other Potentially Applicable Theoretical Approaches That readers were regularly caught zoning out without realizing that they were failing to attend to a task that demanded their attention raises the genuine possibility that people may routinely zone out without realizing it. Although we investigated this phenomenon in the context of reading, it seems quite plausible—if not likely—that zoning out without realizing it is a ubiquitous phenomenon. If so, then the question arises as to why various theoretical views of the relationship between consciousness and behavior have largely overlooked this phenomenon. The explanation for this oversight seems to stem from the simple observation that most theoretical approaches to mindless behavior fail to distinguish between having an experience (i.e., experiential consciousness) and realizing that one is having an experience (i.e., metaconsciousness).

SITUATION AWARENESS The theoretical construct of "situation awareness" (see Durso and Gronlund, 1999, for review) is closely related to that of zoning out. Research on situation awareness examines the factors that affect performance in contexts such as air traffic control or piloting "in which the environment is dynamically changing and the operator is responsible for maintaining or achieving particular states or goals" (Durso and Gronlund, 1999, p. 283), where

situation awareness is said to occur when people tightly focus their attention on the task at hand. Although considerable research has been devoted to documenting the key cognitive elements of situation awareness, including appropriate allocation of attention and adequate working memory resources (Carretta, Perry, and Ree, 1996), little consideration has been given to the metacognitive component of situation awareness. This point is illustrated by the largely overlooked dissociations between situation awareness and meta-awareness. It is possible to have situation awareness with out meta-awareness. For example, when people are engaging in demanding tasks (as when they are tracking dynamic environments), their performance is often optimal when they are not explicitly reflecting on what they are doing (Csikszentmihalyi, 1990). It is also possible to be metaconscious of the fact that one is currently lacking situation awareness. Drivers who listen to books on tape during long drives knowingly sacrifice situation awareness to the extent that they intentionally direct the focus of their attention away from the road. Thus zoning out can be described as an absence of situation awareness, although research on situation awareness does not offer a theoretical explanation of how people can fail to realize that they are zoning out.

MINDFULNESS Another theoretical construct that is highly pertinent to the notion of zoning out while reading is "mindfulness" (e.g., Langer, 2000), which entails being "actively engaged in the present, noticing new things and [being] sensitive to context" (Langer, 2000, p. 220). The construct of mindfulness overlaps substantially with situation awareness but is typically discussed in contexts outside of tracking dynamic environments. As in the case of situation awareness, discussions of mindfulness have typically failed to differentiate between the performance failures associated with mindfulness and the metacognitive failures that allow such lapses to occur in the first place. Much research has been devoted to identifying the situations in which performance will be enhanced by encouraging mindfulness. For example, activities that force people to think more deeply about a task (e.g., by framing it in a more ambiguous manner or asking questions about it) enhance mindfulness (Langer, 2000). Indeed, researchers on zoning out while reading have observed that encouraging mindfulness during reading is critical to maximum comprehension (e.g., Pressley et al., 1995); moreover, the example of mindfulness during reading also highlights the distinction between mindfulness and metaconsciousness. Consider the case of readers deeply absorbed in a novel. Such people are extremely mindful of what they are reading, appreciating the language, visualizing the scenes, and often experiencing the emotions of the characters. Yet, at the same time, they may be said to be lacking in metaconsciousness of what it is that they are doing, which is why we refer to such situations as being "lost in a novel." Thus the construct of mindfulness, while useful in characterizing the state of zoning out, fails to offer the metacognitive elements that would be sufficient to explain how people can fail to notice that they are zoning out in the first place.

THE AUTOMATIC VERSUS CONTROLLED PROCESSING DISTINCTION Central to the notion of zoning out while reading is the observation that people are engaging in a highly complex task without attention. The capacity to perform complex tasks without attention is of course a defining attribute of what is typically referred to as "automatic behaviors" (e.g., Shiffrin and Schneider, 1977). It is relatively straightforward to apply the automatic-controlled processing distinction to the case of zoning out, where whatever process it is that can be described as "reading" (i.e., whatever process allows the eyes to continue moving across the page) presumably involves only automatic processing, which draws on few cognitive resources, whereas the contents of the mind (i.e., whatever thoughts occur during the mind-wandering episode) presumably involve controlled processing, which requires considerable cognitive resources. However, although the automatic versus controlled processing distinction maps onto zoning out while reading, it does not provide a full characterization of the phenomenon for several reasons. First, automatic processing is typically characterized as nonconscious, a characterization that does not seem quite accurate in the case of reading while zoning out, where people may be consciously experiencing their eyes moving across the page, and may even experience the phonology of the words sounding in their mind's ear, but nevertheless fail to elaborate on this experience.

More important, the automatic versus controlled processing distinction does not address the metacognitive aspects of the situation. The unintended thought processes associated with zoning out can reasonably be characterized as involving controlled processing: they demand attention, and their resulting products are consciously experienced. Nevertheless, there is a peculiarity to designating the processes associated with zoning out as "controlled processing" because they ultimately reflect a *failure* of control stemming from the fact that people have lost meta-awareness of what they are doing. Thus the case of zoning out while reading illustrates the importance of including discussions of metaconsciousness into analyses of mental control.

THE COGNITION VERSUS METACOGNITION DISTINCTION On the surface, the distinction between cognitive and metacognitive processes might seem to be the most promising existing approach for conceptualizing zoning out while reading. In introducing the construct of metacognition, Flavell (1979, p. 906) argued that there are two types: metacognitive knowledge corresponding to individuals' general knowledge about what they know, and metacognitive experiences that involve "any conscious cognitive or affective experiences that accompany and pertain to any intellectual enterprise." The experience of suddenly realizing that one has been zoning out certainly represents a metacognitive experience in Flavell's use of the term. Nevertheless, the notion of metacognition in general, and the specific distinction between metacognitive knowledge and metacognitive experience fails to adequately capture the zoning-out phenomenon. As with the other constructs considered above, it is easy to identify dissociations between metacognition and

metaconsciousness. For example, one might well have a metacognitive experience, such as a dull sense of confusion, without explicitly being metaconscious of this experience. At some point one realizes (i.e., becomes metaconscious of the fact) that one is experiencing confusion, but this may be the culmination rather than the beginning of the metacognitive experience that led to this realization.

Ultimately, the inadequacy of the cognition versus metacognition distinction for capturing the zoning-out phenomenon is best illustrated by the simple fact that, although researchers have been exploring the metacognition associated with reading for decades, they have entirely overlooked the phenomenon of zoning out. This problem reflects the fact that, while the distinction between cognition and metacognition recognizes that people may vary in their knowledge about what they know, it does not explicitly acknowledge the possibility that people might lack a basic awareness of the contents of their experience. Accordingly, research on the metacognition of reading has considered people's awareness of how well they are comprehending the text they are reading; but has overlooked their varying awareness of whether they are attending to the text at all.

Having reviewed a number of theoretical distinctions that might apply to the case of zoning out while reading, it seems clear that, while each approach might offer useful insights into the phenomenon, they are all limited by their general failure to recognize that people can have experiences without explicitly recognizing that they are having those experiences. Although the claim that one can be unaware of one's current experience, at first blush, sounds almost nonsensical, it ultimately seems to be the only way to explain why people continue to read even though their mind is occupied by completely unrelated thoughts. Thus an appreciation and understanding of such fluctuations in one's awareness of one's conscious experience is substantially enhanced by considering the notion of a metalevel of consciousness.

A Few Unresolved Questions

We have argued that the metacognitive lapses associated with zoning out while reading have important implications for understanding both the specific cognitive and visual processes associated with reading and the more general manner in which consciousness can become dissociated from metaconsciousness. In closing, we mention just a few of the many questions raised by this analysis.

What Triggers Metaconsciousness?

According to the view that we have been promoting, zone-out lapses are caught when consciousness is directed onto itself. The question thus arises as to what initiates this metalevel of reflection. One condition under which metaconsciousness is initiated is quite clear: people attend to their conscious states when they are explicitly directed to do so. But what about cases in which individuals are

not explicitly reminded to consider whether they have wandered off task? It may be that there is some type of periodic cycle in which metaconsciousness intermittently (at a rate that may vary as a function of the importance of the task and the likelihood that lapses may occur) assesses whether current goals are being met. Or it may be that the tacit monitoring system is sensitive to at least some cues that are indicative of zoning out. For example, pauses in thought (which in principle should not occur if a person is reading fluently) might trigger metaconscious reflection. Various extrinsic cues may also be important. For example, breaks in the text, the turning of pages, environmental sounds, and perhaps even textual conventions (e.g., boldface or italicized text) may interrupt the flow of internal musings, and thereby encourage a moment of metaconscious scrutiny. Future research might profitably explore the contingencies that induce metaconsciousness. Such investigations might enhance our understanding of this largely unexplored monitoring process, and may provide practical tips on how to write texts in order to minimize zoning-out episodes.

Can Zoning Out Sometimes Be Helpful?

However self-evidently counterproductive zoning out may be in many situations, there are certainly situations where it may be useful. If one is engaged in a dull activity that does not require resources, then clearly the tendency for thoughts to move in a more interesting direction is desirable. Indeed, even when reading, it is often helpful for readers to elaborate on the textual information. As noted at the outset, elaborative reading is often crucial for maximum comprehension. The challenge is to enable such elaborations to take place without undermining attention to the text. This analysis suggests that, while a very dull text may encourage zoning out because other topics of thought become inherently more attractive, a highly interesting text may also encourage zoning out by virtue of its thought-provoking nature. Future research may therefore benefit by examining the relationship between zoning-out experiences, text interest, and comprehension, as well as the intriguing possibility that, for certain types of texts, a high incidence of brief zoning-out experiences may actually be associated with superior comprehension performance.

Can We Find Independent Markers of Both Zoning Out and Metaconsciousness?

Although we believe that the relationship between zoning-out reports and various reading comprehension measures provides an important first step in validating individuals' self-reports of zoning out, it is nevertheless clear that a key limitation to our approach is its reliance on self-report measures. One of the key implications of dissociations between metaconsciousness and experience is that self-reports (which necessarily rely on metaconscious rerepresentation of experience) can provide potentially seriously distorted accounts of actual experience (Schooler, 2002). Thus even partially validated self-reports must be taken with a grain of salt. Moreover, even though we found little evidence of reactivity from our measures, it is clear that asking participants to monitor and report their

zone-out experiences must have some effect on the natural occurrence of zone-out experiences. Indeed, it seems quite possible that the introduction of our measures may have reduced the overall frequency of zoning out, thereby providing an underestimation of the frequency with which they naturally occur. It would thus be useful to identify other measures that might provide alternative ways of tracking cases of zoning out. As noted earlier, it seems quite plausible that eye movement during reading may qualitatively change when readers are zoning out. It is also possible that certain electroencephalographic (EEG) measures might be sensitive to fluctuations in coherence (e.g., Klemm, Li, and Hernandez, 2000) depending on whether the information processing associated with what is being read is being integrated with what is being thought about. If such measures revealed signatures of zoning out that corroborated one another and self-reports, then we could have more confidence in self-report measures. Moreover, in principle, it would then be possible to study zoning out without having to rely on self-report measures at all. Such an advance would allow us to investigate a host of intriguing questions such as how often individuals zone out without noticing it, when self-reports and indirect measures are more versus less well calibrated, how long zone-out episodes last, and what situations determine whether a zone-out episode is explicitly caught.

It would also be very informative to explore the neurological markers of meta-consciousness itself. Recent studies, using both event-related potential (ERP) and Functional magnetic resonance imaging (fMRI), have found that the anterior cingulate is especially important in conflict monitoring processes (Carter et al., 1998). There is also some evidence suggesting that the area of the cingulate activated depends on whether the monitoring process is implicit or explicit (van Veen and Carter, 2002). Future imaging research might profitably explore the relationship between activation of the cingulate and both the occurrence of zoning out and the metaconscious realization that one is zoning out. Such an analysis could provide a foundation for a model of cognitive monitoring grounded both in brain activity and in phenomenological experience.

Note

1. What we refer to as "experiential consciousness" has previously been called "phenomenal consciousness" (Block, 2001) and "perceptual consciousness" (Armstrong, 1998). And what we refer to interchangeably as "meta-awareness" or "metaconsciousness" has previously been called "reflexive consciousness" (Farthing, 1992), "introspective consciousness" (Armstrong, 1998), and "reflectivity" (Block, 2001). Although this distinction is clearly more important than the particular terms we use to characterize it, apt, precise terminology helps to ensure accurate communication and to avoid the sleight of hand that can occur when conclusions appropriate to one meaning of a term are inappropriately applied to a different meaning of the same term. We are partial to the terms *meta-awareness* (see also Cicogna and Bosinetti, 2001; Jack and Shallice, 2001; Schooler, 2001) and *metaconsciousness* (Schooler, 2002) for several reasons. First, the notion of metaconsciousness as consciousness of consciousness aptly captures Tarski's "meta" construct (1956, 1985) of "whatever about whatever." Second, the terms *metaconsciousness* and *meta-awareness* highlight the importance

of relating metacognition to consciousness—a fruitful endeavor (see Nelson, 1996) that occurs surprisingly seldom. Finally, although any of the previously used terms could capture the distinction, many bear the burden of multiple connotations. Although the terms *consciousness* and *awareness* also hold multiple meanings, it is their shared meaning that most closely captures the basic concept of consciousness as being the contents of one's subjective experience. Thus applying the "meta" prefix to both "awareness" and "consciousness" may help to ensure that both resulting compounds draw on the common meaning of "consciousness" that the two base terms share.

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