Bridging the Objective/Subjective Divide

Towards a Meta-Perspective of Science and Experience

Jonathan Schooler

In this paper I use the thesis that perspective shifting can fundamentally alter how we evaluate evidence as the backdrop for exploring the perennial challenge of bridging the divide between the subjective first-person perspective of experience, and the objective third-person perspective of science. I begin by suggesting that reversible images provide a metaphor for conceptualizing how the very same situation can be understood from two very different perspectives that appear to produce seemingly irreconcilable accounts of their contents. However, when one recognizes that both views are different vantages on some deeper structure, a meta-perspective can emerge that potentially offers a vantage by which the opposing perspectives can be reconciled. Building on this notion of a meta-perspective, I outline a framework for conceptualizing how science can draw on individuals' first-person experience in order to explicate those experiences within the necessarily third-person perspective of science. I then show how this approach can illuminate one of the most private yet ubiquitous aspects of mental life: mind-wandering. Finally and most speculatively, I attempt to tackle the enduring ontological tensions that emerge from the disparities between the first- versus third-person perspectives. Specifically, I suggest that the present prevailing third-person perspective of material reductionism fails to adequately account for the first-person experience of subjectivity, the flow of time, and the present. While I argue that these differences are an intrinsic property of each perspective, and thus irreconcilable from the vantage of either, I raise the possibility of a meta-perspective in which these clashes might be better accommodated. Toward this end, I speculatively suggest that experience, the flow of time, and the unique quality of "now" might be accommodated by the postulation of a subjective dimension or dimensions of time.

Keywords
Consciousness | Heterophenomenology | Meta-awareness | Meta-perspective | Mind wandering | Mind/body problem | Neurophenomenology | Neutral monism | Panpsychism | Phenomenology | Time

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1 Introduction

I am the proud owner of a philosopher's stone. Although it does not hold any of the mysterious powers (e.g., turning lead to gold, providing endless youth) that the alchemists attributed to its namesake, I nevertheless feel its title fitting, as it offers some rather deep insights into the importance of perspective in defining what seems true. What distinguishes my stone from an ordinary river rock is that it has engraved upon it the statement "Nothing is written in stone." In pondering its irony, I've come to realize that my philosopher's stone can be viewed in at least three ways, each leading to a different accounting of its merit. From one vantage the statement on the stone is self-evidently false, as clearly revealed by where it is carved.

From another it is demonstrably true, as the word "nothing" is written in stone right there. Finally, the fact that the presentation of the stone's message simultaneously reveals it to be both true and not true enables the stone to clarify the paradoxical essence of its meaning. Nothing is definitive because a change in perspective may shift what is seen as factual. However, the stone further illustrates that when one recognizes how the perspectives that one takes influence the conclusions that one draws, one gains a larger meta-perspective that can accommodate them both.

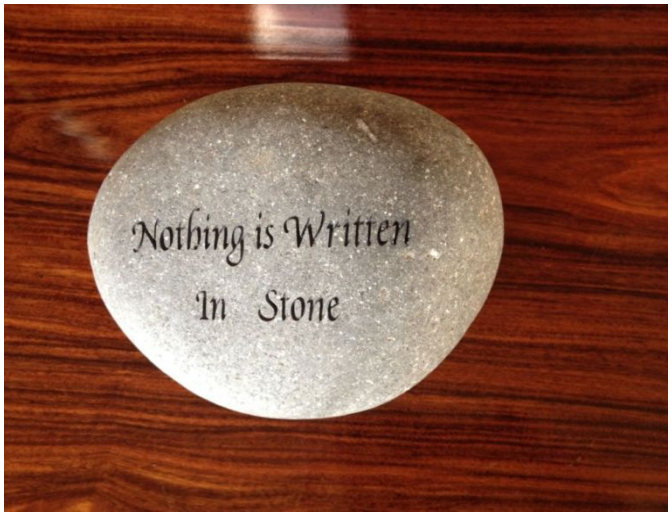

Figure 1: From one perspective, as evident from the place onto which it is carved, "Nothing is Written in Stone" is a contradictory statement. However, from another perspective, "Nothing" is in fact written in stone, making the statement true. Thus, "Nothing is Written in Stone" illustrates that when one recognizes how the perspectives that one takes influence the conclusions that one draws, one gains a larger meta-perspective that can accommodate them both.

Although it is relatively straightforward to describe the manner in which my philosopher's stone conveys how shifting perspective can alter what is seen as true, such descriptions do not do justice to the impact the stone has when one actually encounters it. The stone not only conveys its message, it embodies it. Its message thus speaks not only to one's capacities of logic but also viscerally, physically, through one's senses. Indeed this difference between the third-person *account* of something and the first-person *experience* of it is perhaps the ultimate example of the manner in which perspective can alter how we understand the world.

In this paper I attempt to nudge the field towards a rapprochement between the subjective first-person perspective of experience and the objective third-person perspective of science. My efforts are divided into three somewhat distinct sections; all united by the goal of illustrating how the divide between the subjective and objective might begin to be bridged by a broader perspective that acknowledges that while neither can be reduced to the other, they may be alternative vantages of a larger meta-perspective.

In the first section, I use the analogy of reversible images to emphasize the importance of perspective shifting in recognizing that views that seem one way from one perspective may seem quite different from another. However, when one recognizes that both views are different vantages on some deeper structure, a meta-perspective can emerge that potentially offers a vantage by which the opposing perspectives can be reconciled. I propose that the relationship between the first-person perspective of subjective experience and the third-person perspective of objective science can be conceptualized in this manner, and that at least some of the heated debate between scholars on this topic may stem from their exclusively favoring one vantage over the other.

In the second section, I illustrate how the third-person perspective of science can both draw on and elucidate first-person experiences, and in particular the ubiquitous internal state of mind-wandering. I argue that although people's self-reports of private internal experiences such as mind-wandering necessarily rely on a re-representation of the experience to themselves (meta-awareness), we can nevertheless draw inferences about their underlying experience by examining the relationship between self-reports and physiological and behavioral measures. Triangulation between these measures has highlighted both the strengths and limitations of people's meta-awareness of their drifting minds: although people frequently fail to notice that their minds are wandering, when queried they are quite accurate at reporting whether

or not their minds were on task. This analysis thus reveals the value of using empirical third-person science to clarify the nature of first-person experience.

In the final section I consider how first-person experience may inform our understanding of objective reality. Current views of science offer no way of accounting for the existence of subjective experience, the flow of time, or the privileged present, leading mainstream science to marginalize these essential elements of consciousness as irrelevant or illusory. However, from my vantage these aspects of existence are at least as certain as physical reality itself. It seems nonsensical to characterize experience as an illusion, because even an illusory experience (i.e., where the contents have no bearing on physical reality) is still an experience. Moreover, experience exclusively resides in an ever-changing present. A characterization of reality that has no place for subjective experience, the flow of time, or importance of the present seems devoid of the core aspects of my existence. In keeping with others who have speculated that theories of physical reality will need to be expanded to accommodate subjective experience, I conjecture that consciousness may correspond to movement in an additional subjective dimension (or dimensions) of time. Although this hypothesis is highly speculative, it provides an example of the kind of meta-perspective that may be necessary to successfully accommodate subjective and objective views.

Clearly I have my work cut out for me. However, before embarking on the more ambitious aspects of this journey, let us first step back and consider the nature of perspective and the impact that it can have on understanding.

2 Applying perspective shifts to conceptualizing human experience from the first- versus third-person perspective

The striking parallels between perceptual and conceptual perspective shifts exemplify the embodiment of mental capacities in physical experience (Schubert & Semin 2009). Colloquially, when we talk about dramatic shifts in conceptual understanding, we routinely use perceptual metaphors (Schooler et al. 1994). We speak of "thinking out of the box," or of "stepping back and looking at the bigger picture." Even the term that we use for gaining a fresh perspective on an old problem, i.e., "insight," directly alludes to the parallels between perceptual and conceptual perspective shifting. It is no coincidence that the Gestalt psychologists who pioneered research on visual perspective shifting (Wagemans et al. 2012) also were the first to investigate the processes of conceptual insight (Duncker 1945). And indeed, research in our lab (Schooler & Melcher 1995) reveals a strong correlation between people's ability to make perceptual insights (e.g., recognizing out-of-focus pictures) and conceptual insights (e.g., solving insight word problems). Thus, in order to explore how perspective may constrain our conceptual understandings, it is helpful to start by briefly considering the ways in which perspective can influence perceptual experiences. As will be argued, the manner in which alternative first-person perceptual perspectives constrain our experiences, provides a compelling metaphor for the broader contrast between first- and third-person perspectives that individuals face in reconciling their personal subjective experiences with objective reality.

One of the greatest challenges of visual perspective is recognizing how fluid it really is. Typically, when we view an object or a scene, we apprehend it from a particular vantage and rarely consider the possibility that it may be seen in a different way. If and when a shift occurs, the experience is typically characterized by a marked surprise that the very same view could afford such a different understanding. The Gestalt reversible figures are a quintessential example of images that startle us with their alternative perspectives. At first when we encounter them we often perceive them from only one perspective; that is, although there are several possible interpretations of the image, we assign one set of perceptual properties to the elements of the image (front or back, figure or ground), and one conceptual interpretation of the object (e.g., duck or rabbit, young woman or old hag).

When presented with an image of a duck/rabbit as a duck, those unfamiliar with the image may initially see only a duck. However, if alerted to the possibility of another embedded image, suddenly a rabbit may virtually pop out. Other classic examples of reversible images include: a Necker cube facing one way or another, a vase or a pair of faces, a young woman or an old hag. A particularly compelling recent addition is the spinning dancer illusion, where a perceptual shift not only changes one's perspective of her orientation but also the direction in which she appears to be spinning.

Figure 2: The duck-rabbit illusion is a classic example of a perspective-dependent reversible image. When presented as a duck, those unfamiliar with the image may initially see only a duck. However, if alerted to the possibility of another embedded image, suddenly a rabbit may pop out. McManus, I. C., Freegard, M., Moore, J., & Rawles, R. (2010). Science in the making: Right hand, left hand. II: The duck–rabbit figure. *Laterality, 15*, 167.

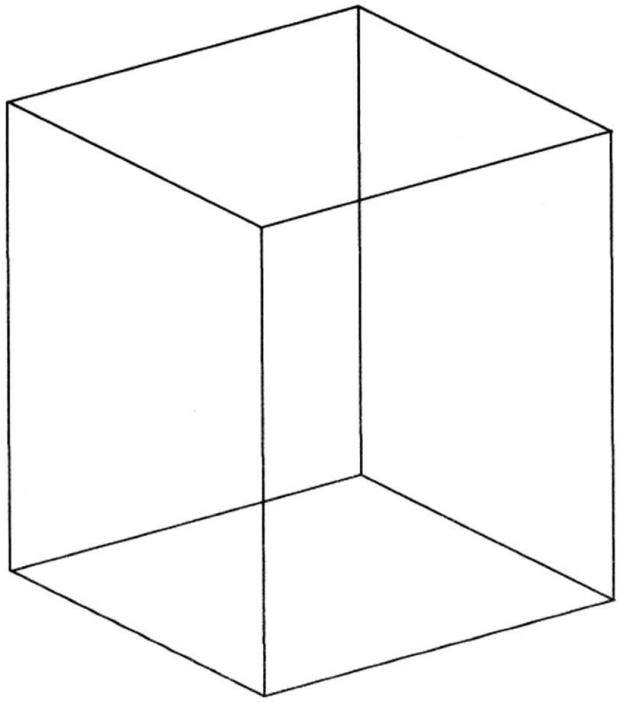

Figure 3: The Necker cube is a reversible image that, depending on the perspective taken by the observer, appears to be facing one way or another. Shifting one's perspective allows the observer to view the cube either from slightly above or slightly below. Necker, L.A. (1832). Observations on some remarkable optical phenomenon seen in Switzerland; and on an optical phenomenon which occurs on viewing a figure of a crystal or geometrical solid. *London and Edinburgh Philosophical Magazine and Journal of Science*, 1 (5), 329–337.

There are several notable aspects of all the aforementioned visual perspective shifting examples. First, before one knows that there are multiple interpretations, it is common to only perceive one or the other. Second, once one is aware of both perspectives, one can experience an oscillation between the two, shifting from one perspective to the other, and back again. Third, at any one moment in time, it is impossible to simultaneously see both interpretations. The Necker cube is either seen facing one way or the other; the spinning dancer only rotates in one direction at a time. Finally, although one can only perceive one interpretation at a time, one can nevertheless know that multiple perspectives exist, and this knowledge provides a *meta-perspective*, whereby we appreciate that what we

perceive one way at one moment can be perceived in a very different way in the next.

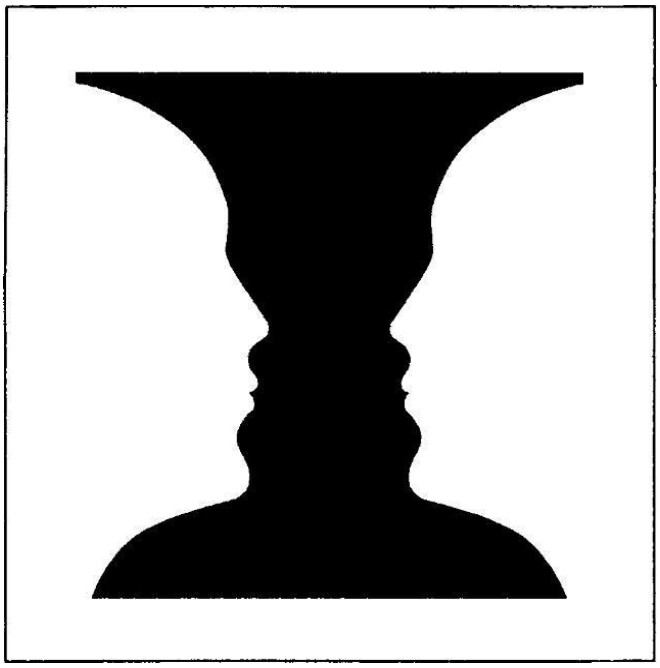

Figure 4: Rubin's vase (sometimes referred to as "The Two Face, One Vase Illusion") depicts the silhouette of a vase in black and the profiles of two inward-looking faces in white. The figure-ground distinction made by the brain during visual perception determines which image is seen. Ittelson, W. H. (1969). *Visual Space Perception*, Springer Publishing Company, LOCCCN 60-15818

A particularly remarkable class of perceptual shift that enables us to switch to a meta-perspective comes from "Magic Eye" stereograms that can reveal a full holographic three-dimensional realm that is not initially perceptible at all. These stereograms entail images that first are viewed as a two-dimensional pattern. However, if one stares at the image long enough in just the right way (this requires a little eye crossing) and believes that it is possible to actually see into it, an entirely different and fully three-dimensional image emerges. What is so striking about these "Magic Eye" stereograms is that the embedded three-dimensional images have absolutely no resemblance to the two-dimensional images from which they emerge. There is of course a sophisticated algorithm (based on principles of stereopsis) that enables the three-dimensional perception to arise from the two-dimensional image, but the experiences of the two images are wholly of a different sort. Those who have not gotten into a Magic Eye image can have no idea what the underlying image looks like, and even if they are shown what the form is, they cannot appreciate what it is like to actually witness the two-dimensional page miraculously open up into a three-dimensional world that is somehow residing within it. However, those who have experienced this transformation gain a wholly different appreciation for the image, recognizing that it affords two entirely different vantages, even while appreciating that only one can be apprehended at any particular time.[1]

The lessons learned from perceptual perspective shifting are relevant to the long-standing tension between conceptualizing human experience from the first- versus third-person perspective. Not unlike the shifting perspectives of a reversible image, the field of psychology has vacillated back and forth between focusing on people's self-reported internal experiences (the first-person perspective) and their observable behaviors (the third-person perspective). Moreover, just as the spinning dancer can move in one direction for a while, then flip back and forth in direction, and then carry on in the opposite direction, the field has had periods of relative steady focus on one or the other vantage and other periods in which the vantage was more variable.

1 A possible objection to the Magic Eye stereogram as an illustration of a shifting perspective is that it can be enabled merely by a musculature action (the crossing of the eyes). One reviewer suggested that the new representation that emerges from these images may be no "more interesting than the muscular action of opening a closed eye which also allows the appearance of a suddenly unseen picture." While a worthwhile observation, I do not think it challenges the relevance of the example. First, closing one's eyes is not a different vantage of an image; it is a lack of a vantage at all. Second, like other reversible images whose shifting interpretation can be enhanced by movement of the eyes, the muscular adaptations required for seeing the alternate image of a Magic Eye stereogram is a necessary but not sufficient condition for its reinterpretation. This is illustrated by the fact that many people, despite all efforts of eye crossing, are incapable of entering them and that those who do have the good fortune to be of being able to experience them typically must engage in sustained cognitive effort to unpack the image once they begin to get into them. The central point of the Magic Eye example is that it illustrates how changing vantages on what one is looking at can profoundly influence what one believes to be true about it. The fact that this changing vantage may require a little eye crossing does not, in my view, lessen this observation.

Figure 5: The young girl-old woman illusion (otherwise known as "My Wife and My Mother-in-Law") is a reversible image in which the viewer may either observe a young girl with her head turned to the right or an old woman with a large nose and protruding chin, depending on one's perspective. Wright, E. (1992) The original of E. G. Boring's Young Girl/Mother-in-Law drawing and its relation to the pattern of a joke. *Perception, 21*, 273–275.

The inception of psychology was marked by a concern with the inner experience of the individual (Schultz & Schultz 1992). Introspection was the tool of choice, and research entailed asking participants to scrutinize the components of their experiences. In short, psychology began with a fixed first-person perspective. In fact, it was during this time that psychology created some of its most robust laws of psychophysics demonstrating strikingly rigorous relationships between changes in various perceptual estimates (e.g., perceived brightness, weight, volume) and changes in the physical stimuli themselves (for a history, see Murray 1993). Then, concerns about the value of introspection arose, and researchers began to vacillate regarding the value of introspection relative to more "objective" third-person perspectives. Although some researchers (notably the Gestalt psychologists and other researchers in the domain of human perception, e.g., Katz 1925/1989) continued to maintain a concern with inner experience, for a significant period of time the behaviorist reign caused a shift toward disregarding people's first-person perspectives. Internal experience was a taboo topic. In short, psychology switched to a fixed third-person perspective. Then, with the rise of information processing and the cognitive era, the field again began to vacillate back and forth between considering people's internal experiences and focusing on their behavior.

Figure 6: The spinning dancer illusion, or silhouette illusion, depicts a woman spinning in a circle. The direction of the dancer's spinning (clockwise or counterclockwise) is dependent on the perspective taken by the observer. Kayahara, Nobuyuki (2003). Silhouette Illusion. *ProCreo*. Retrieved from http://www.procreo.jp/labo/labo13.html

While psychology again finds itself in an age of flipping perspectives about first- versus

third-person accounts, much consternation still arises from this fact. Science in general (Wilber 1998) and psychology in particular (Wallace 2000) still find it challenging to fully integrate subjective experience into their accounts. Just as it is impossible to see a Necker cube simultaneously facing in its alternative directions, so too psychology has struggled to reconcile its vacillation between first- and third-person perspectives. On the one hand, ignoring the inner realm of experience seems to leave out much of "what it is like" to be human (Nagel 1974). On the other hand, researchers are rightly concerned about the validity and meaning of people's first-person reports (Wilson 2003). With no alternative window into people's minds, how can we know that their reports accurately correspond to their inner experience? After all, science necessarily relies on mutually agreed-upon observations. So how can we evaluate the first-person perspective that by its very nature eludes such consensus? The challenge is how to translate these first-person experiences into third-person data that can be scientifically investigated. The most straightforward answer of course is simply to ask people about their experience; their observable verbal statements thus become the third- person window onto their first-person experiences. But here we run up against the challenge that caused psychology to abandon the first-person perspective in the first place: How do we know if self-reports line up with first-person experiences without some independent measure of people's internal states (Bayne this collection)?

Fortunately, self-reports are not the only third-person window into people's inner experience. We can also examine other behaviors as well as measure physiological and brain activity in order to make reasoned inferences about what individuals are genuinely experiencing. In this manner, we can begin to discern when people are accurately characterizing their internal experience, and when they may be overlooking or distorting key aspects. The approach that I am advocating here is very much in keeping with Dennett's notion of heterophenomenology (2003) that takes at its starting point the premise that people's self-reports do not necessarily reflect what they are actually experiencing but rather "*what the subject believes to be true about his or her conscious experience*" (Dennett 2003, p. 2). Although such an approach refrains from necessarily taking people's first-person reports on face value, it does not abandon the prospect of making inferences about what people are actually experiencing.[2] Rather it posits that we must evaluate people's self-reports in light of other third-person measures. As Dennett (1993) puts it:

> My suggestion, then, is that if we were to find real goings-on in people's brains that had enough of the 'defining' properties of the items that populate their heterophenomenological worlds, we could reasonably propose that we had discovered what they were really talking about—even if they initially resisted the identifications. And if we discovered that the real goings-on bore only a minor resemblance to the heterophenomenological items, we could reasonably declare that people were just mistaken in the beliefs they expressed, in spite of their sincerity. (p. 95)

As will be argued there are at least some situations in which external observers may have better knowledge of a person's internal state than does the person in question. Moreover, there are some mental states (e.g., mind-wandering) for which the crucial bottleneck in people's introspective awareness stems not from their capacity to classify the experience, but rather from the fact that people only intermittently take stock of what is going on in their own minds.

In the following section, I review some of the insights about first-person experience that can be gained when it is assessed from a third-

2 In the past (Schooler & Schreiber 2004) I characterized Dennett as dismissing the notion of underlying experience altogether, noting that he has written "Nobody is conscious... we are all zombies" (Dennett 1993, p. 406). Although I still find his views on this issue somewhat slippery, I now believe that he endorses the existence of genuine phenomenal experience that can be validated with third- person evidence. For example Dennett (2003) argues that evidence about briefly presented stimuli could help to inform subjects about their actual conscious experience observing "Subjects would learn for the first time that they were, or were not, conscious of these stimuli" (p. 9).

person perspective. By adopting a "trust but verify" approach to first-person reports, we not only gain a more objective understanding of subjective states, but also potentially glean a more astute perspective of our own experience.

Figure 7: "Magic Eye" stereograms can reveal a holographic three dimensional realm that is not initially perceptible at all. Consisting of abstract visual patterns constructed from an algorithm based on the principles of stereopsis, "Magic Eye" illusions require the viewer to blur their vision for a period of time, thereby revealing a three-dimensional imprint once perspective has shifted. Image provided by eyetricks.com Additional examples can be found at http://www.magiceye.com/3dfun/stwkdisp.shtml.

3 Gaining a third-person perspective on people's first-person experience

On some occasions we simply have experiences, but at other times we reflect on those experiences; that is, we intermittently take stock of our ongoing experience and re-represent it to ourselves. This distinction between having an experience (experiential consciousness) and explicitly re-representing it to ourselves (meta-awareness) is illustrated by the example of mind-wandering while reading (Schooler 2002). All of us have had the experience of reading along and suddenly realizing that, despite our best intentions, our eyes have been moving across the page but our minds have been entirely elsewhere. Indeed this has likely happened to a goodly proportion of the readers whom have made it this far. The immediate question that this common experience raises is: why do we continue to simultaneously read and mind-wander even though we know that it is impossible to fully do both at the same time? The answer I suggest, and I'll offer more evidence for this contention shortly, is that we routinely lose track of the contents of our own minds. People continue mind-wandering while reading because once they begin to mind-wander they often temporarily fail to notice (i.e., become meta-aware of) the fact that their minds are thinking about something unrelated to the text.

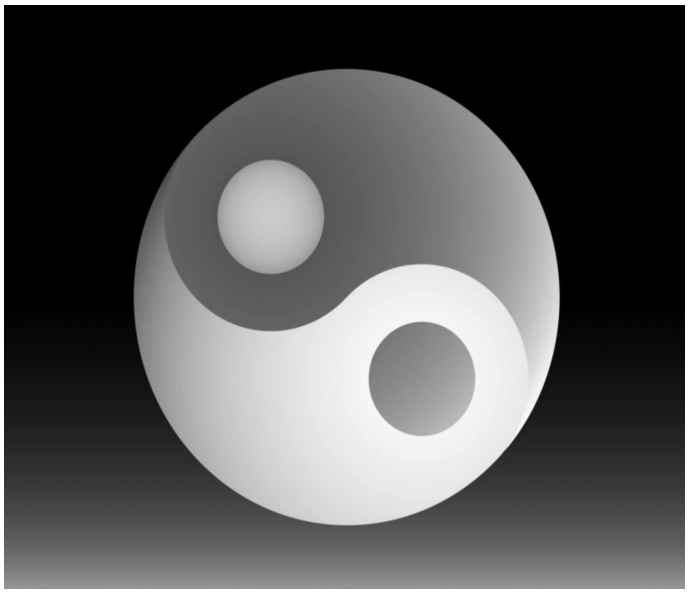

Figure 8: The three-dimensional image is a three dimensional yin-yang which the original Magic Eye image would not have revealed without a shift in perspective. The embedded three dimensional image has absolutely no resemblance to the two dimensional image from which it emerges. Image provided by eyetricks.com.

The notion that people routinely shift in perspective (from simply experiencing to attempting to re-represent their experience to themselves) provides the foundation for a framework for scientifically investigating first-person experience. Specifically, the distinction between experiential consciousness and meta-awareness raises the prospect of two types of dissociations between these vantages that are empirically tractable (Schooler 2002). *Temporal dissociations of meta-awareness* involve situ-

ations in which individuals engage in an experience without explicitly realizing that they are doing so. The example of temporarily failing to notice that one is mind-wandering is an example of a temporal dissociation. *Translation dissociations of meta-awareness* occur when one distorts or otherwise mischaracterizes their experience to themselves. Shouting "I am not angry" at the top of one's lungs is an example of this latter dissociation. In the following discussion I briefly outline the empirical approach for exploring these two types of dissociations.

3.1 Temporal dissociations of meta-awareness

Although failing to notice that one is mind-wandering is a particularly apt example of a temporal dissociation of meta-awareness, there are numerous other examples of experiences that can temporarily go without being explicitly noticed, including unnoticed emotions (Lambie & Marcel 2002; Schooler & Mauss 2010) suppressed thoughts (Baird et al. 2013), and various mindless behaviors (Schooler et al. in press). Temporal dissociations of meta-awareness readily lend themselves to empirical investigation. Two approaches have proven effective in delineating situations in which people temporarily fail to notice a particular mental state: self-catching versus probe-catching and retrospective measures (Schooler et al. 2011).

The self-catch/probe-catch methodology pits two common self-report techniques against one another. Participants are asked to indicate every time they notice a particular mental state (e.g., mind-wandering). If an individual reports that they have just noticed themselves engaging in that mental state, then this is by definition a demonstration that the mental state has reached meta-awareness. Thus, self-caught episodes provide a straightforward measure of mental states of which individuals have become meta-aware. However, within this methodology, participants also periodically receive experience-sampling probes (Hurlburt & Heavey 2001) in which they are asked whether, at that particular time, they had been engaging in that mental state. If people are caught engaging in the state before they notice it themselves (via self-catching), this provides a metric of episodes of that state that have eluded meta-awareness. As will be detailed later, this approach has proven effective in documenting temporal dissociations of a variety of different mental states including both mind-wandering (Schooler et al. 2004; Sayette et al. 2009; Sayette et al. 2010) and unwanted thoughts (Baird et al. 2013).

A second approach for identifying temporal dissociations of meta-awareness is to rely exclusively on experience sampling probes (i.e., probe-catching) but to additionally query people when they are caught in a particular state (e.g., mind-wandering) regarding whether or not they had been previously aware of that fact. Again, as will be seen, this strategy routinely reveals that people can be caught engaging in mental activities that they were previously experiencing but were not explicitly aware of. Intriguingly, the findings with this measure of temporal dissociation align with those revealed by the self-caught/probe-caught methodology to reveal consistent systematic differences between mental states associated with meta-awareness and those that lack it.

3.2 Translation dissociations of meta-awareness

Translation dissociations correspond to situations in which, while in the process of re-representation, one omits, distorts, or otherwise misrepresents one's mental state to oneself and/or others. The basic strategy for assessing translation dissociations is to examine the correspondence between individuals' self-reports of their mental states and indirect measures that might reasonably be expected to correspond to that state (Schooler & Schreiber 2004). If the correspondence is high, there is good reason to think that individuals are accurately reporting their internal state. If the correspondence is low, one needs to at least be suspicious that people are mischaracterizing their mental state.

Emotions are likely to be a particularly common source of translation dissociations. For example, when individuals report experiencing anxiety, a host of physiological measures (includ-

ing heart rate and galvanic skin response) typically become elevated (Marks 1987). Such correspondence gives us confidence that people are accurately characterizing their internal state; in other words, there is no translation dissociation. However, there is a class of individuals, referred to as repressors, who show the standard physiological changes when put in situations that would cause most people to experience anxiety, but who fail to report any change in anxiety (Asendorpf & Scherer 1983). In these cases, it seems reasonable to speculate that the repressors are misrepresenting their internal experience to themselves; they are experiencing anxiety but not acknowledging it (Lambie & Marcel 2002; Schooler et al. in press). As another example, consider that when males experience sexual arousal they typically show changes in their penile tumescence (a technical way of saying they become erect). Intriguingly, men who reported disgust for homosexual activity were shown to actually exhibit greater increases in penile tumescence when witnessing males engaging in sex, than men who did not report aversive feelings toward homosexuality (Adams et al. 1996). One reasonable account of these findings is that these so-called homophobics experience a translation dissociation, such that they are unable to acknowledge the arousal that they feel towards men, and instead misattribute the experience to a feeling of disdain.

A final example of translation dissociations involves situations in which individuals analyze why they feel the way they do about an affective experience. For example, in one study (Wilson et al. 1993), participants viewed various art posters and then both rated the posters and selected one to take home with them. Prior to engaging in this assessment, some participants were further asked to analyze why they felt the way they did about the posters, whereas others were not. When contacted several weeks later, people who had attempted to reflect on the basis of their preferences were less satisfied with their choice and were less likely to have hung the poster on their wall than those who had not analyzed their reasons. The disruptive effects of analyzing reasons, which have been conceptually replicated in a variety of contexts (Wilson & Schooler 1991), suggest that sometimes self-reflection may be a source of translation dissociations. That is, in the process of trying to understand why people feel the way they do, they may construct a faulty meta-conscious representation and thereby lose touch with their feelings.

3.3 Investigating temporal and translation dissociations of meta-awareness in the context of mind-wandering

In recent years, a growing body of research has addressed the nature of mind-wandering as it pertains to the occurrence of temporal and translation dissociations of meta-awareness. This research suggests that mind-wandering is highly susceptible to temporal dissociations of meta-awareness; that is, individuals routinely fail to notice that their minds are wandering despite the considerable disruption to performance that such unnoticed lapses often incur. This claim is supported by various strands of evidence revealing the frequency with which participants are routinely "caught" mind-wandering before they notice it themselves. In contrast, mind-wandering appears to be relatively resistant to translation dissociations of meta-awareness. Although individuals regularly fail to notice when their minds are wandering, when meta-awareness is directed toward the current state of thought, they are generally quite accurate in characterizing whether or not their minds were on-task. This latter claim is supported by numerous demonstrations of systematic differences in performance and neurocognitive activity as a function of individuals' self-classifications of their mental state as on-task versus mind-wandering.

3.3.1 On the veracity of self-reports of mind-wandering: How susceptible is mind-wandering to translation dissociations?

A fundamental challenge to the investigation of mind-wandering is its necessary reliance on self-report. Mind-wandering is, by its very nature, defined in terms of internal mental states. Given psychology's long suspicions about introspective evidence (Nisbett & Wilson 1977), this reliance

on self-reports likely contributed to why, until recently, consideration of this important topic was largely limited to a few stalwart researchers (Antrobus 1999; Klinger 1999; Singer 1988; Giambra 1995). However, accumulating evidence suggests that when individuals are directly queried regarding whether they are mind-wandering, their self-reports accurately reflect their internal mental state. Evidence for this claim is largely based on the logic of triangulation (Schooler & Schreiber 2004). Accordingly, if self-reports of mind-wandering consistently co-vary with behavior and neurocognitive activity in a manner that might reasonably be expected to be impacted by mind-wandering, then we can have increased confidence that such introspective evidence accurately reflects the underlying mental state. In the following review, I detail at some length numerous findings in support of this relationship from a host of paradigms in which potential behavioral or physiological proxies of mind-wandering are related to individuals' responses to randomly timed queries regarding whether they were just mind-wandering. This review provides a review of the extensive literature on mind-wandering and evidence for the general contentions that: 1) the concordance between behavioral and physiological measures and self-report data indicate that people's self-reports of mind-wandering correspond to actual instances of this mental state; and 2) while people are routinely able to recognize mind-wandering after the fact, they often fail to notice it while it is occurring. Readers willing to take my word on these two points may want to scan or skip this section and jump ahead to its *Summary* (on page 16) or to the *Implications of this approach for the more general enterprise of the science of first-person perspective* (on page 18) if the general topic of mind-wandering is not of primary interest.

3.3.1.1 Behavioral measures

Reading comprehension

Although long overlooked as a source of reading comprehension failure, Schooler et al. (2004) found a strong correlation between the frequency of mind-wandering reports in response to experience sampling probes and comprehension accuracy. Subsequent work demonstrated that mind-wandering specifically disrupts the development of a detailed situational model Smallwood et al. 2008).

Another way in which the absence of reading comprehension following mind-wandering has been documented is through the examination of people's capacity to detect when the text becomes gibberish. In one study (Zedelius et al. 2014) participants were asked to read simple children's texts and report every time they noticed that the sentences no longer made any sense (some of the sentences were constructed so that the nouns of the sentences were rearranged in a nonsensical manner, e.g., "This sense makes no sentence"). The results revealed that participants sometimes continued reading for a number of sentences before noticing that the text had become gibberish. Moreover, participants who received thought probes after several sentences of gibberish were more than twice as likely to report mind-wandering without meta-awareness, relative to those who were probed at random times.

Eye-movements

If individuals' self-reported mind-wandering episodes during reading correspond to genuine mental lapses, then we might also reasonably expect to see differences between the patterns of gaze durations following periods in which individuals report reading attentively versus mind-wandering. These predictions were confirmed in an experiment in which subjects read the entirety of Jane Austen's *Sense and Sensibility* while their eye movements were recorded (Reichle et al. 2010). Relative to eye movements obtained during intervals of normal reading, the fixations measured during intervals that preceded reports of mindless reading were both longer in duration and less modulated by variables that are known to influence fixation durations (e.g., word frequency, Rayner 1998). These results suggest that the fairly tight coupling between the mind and eye during normal reading (Reichle 2006) becomes disengaged during self-reported mind-wandering.

Sustained Attention to Response Task (SART)

Another paradigm that has proven effective in documenting the validity of mind-wandering reports is the SART task. The SART is a simple go/no-go task in which participants are asked to refrain from responding to an infrequent no-go target (Manly et al. 1999; Robertson et al. 1997). Studies have documented that the brief lapses associated with this task share important features associated with reports of off-task thought. For example, individual difference measures such as cognitive failures (Smallwood et al. 2004), depression (Carriere et al. 2008; Farrin et al. 2003; Smallwood et al. 2007), and poor executive control (McVay & Kane 2009) have been associated both with greater mind-wandering reports and more errors on the SART. Similarly, both off-task reports and errors in this task share similar information processing features in terms of measures such as reaction time (RT) and evoked response potentials (ERPs; Smallwood et al. 2008, 2004, 2007).

3.3.1.2 Neurocognitive measures

Evoked Response Potential

When the brain faces situations in which it toggles between alternative perspectives, it routinely temporarily inhibits one perspective in favor of the other. This dampening of the non-dominant perspective is shown in reversible figures, where brain activation of one interpretation is inhibited while the other is consciously experienced (Tong et al. 2006). This same process of dampening the nondominant vantage also appears to operate when people favor their internal train of thought over external events. Accordingly, reports of mind-wandering should be associated with a dampening of attention to external stimuli. Indirect support for this "decoupling hypothesis" comes from studies demonstrating that participants are more prone to errors during periods associated with self-reported attentional drifts (e.g., Carriere et al. 2008; Smallwood et al. 2004; Weissman et al. 2006) and that they are less likely to recollect external events during these periods (Smallwood et al. 2003, 2007, 2004).

More direct support for a relationship between self-reports of mind-wandering and dampened external processing comes from several ERP studies. In one study (Smallwood et al. 2008), participants intermittently received experience sampling probes while performing a simple target discrimination task. Analysis of the ERP responses to the targets revealed that the amplitude of the P3 ERP component elicited by the targets was significantly reduced for targets associated with "off-task" relative to "on-task" reports. Given that the P3 component reflects the degree to which external events are cognitively analyzed (e.g., Donchin & Coles 1988), these initial data support the proposal that mind-wandering reports are associated with an attenuation in stimulus processing at relatively late, post-perceptual processing stages.

A more recent ERP study examined whether mind-wandering might also attenuate sensory-level cortical processing (Kam et al. 2011). Participants again performed a simple discrimination task (at fixation) while being prompted at random intervals to report on their attentional state, but this time we also included task irrelevant probes in the visual periphery. The results revealed that the initial sensory-evoked response to probes was significantly attenuated prior to reports of "off-task" attentional states, as measured via the visual P1 ERP component. A second experiment that included irrelevant auditory probes similarly revealed that sensory-level auditory processing in the cortex is also dampened during self-reported "off-task" states, as measured via the auditory N1 ERP component. Another recent study from our lab (Baird et al. 2014) replicated the finding that mind-wandering reduced the P1 ERP, and further revealed that mind-wandering was associated with decreased phase-locking of electroencephalograph (EEG) neural oscillatory activity to sensory stimuli, suggesting that mind-wandering disrupts the temporal fidelity with which the brain responds to a stimulus.

Taken together, the collective ERP and EEG evidence demonstrates that self-reports of mind-wandering correspond to attenuated sens-

ory processing and cognitive appraisals of external stimuli. This finding further confirms the validity of self-reports of mind-wandering and suggests that a central feature of the mind-wandering state is an attenuation of the processing of external stimuli.

Functional magnetic resonance imaging (fMRI)

One of the challenges facing the burgeoning discipline of cognitive neuroscience is making sense of the observation that several brain areas, including the posterior parietal cortex and the precuneus, the medial prefrontal cortex, and the medial temporal lobe (which are collectively known as the default mode network (DMN), Raichle et al. 2001), all exhibit high levels of activity when participants have no external task to perform. One candidate process that the DMN could serve is the generation of the stimulus-independent thoughts that occur during the mind-wandering state, a hypothesis that is supported by a growing body of evidence. For example, McGuire et al. (1996) used the technique of retrospective thought sampling to demonstrate that reports of mind-wandering were associated with activity in the medial prefrontal cortex. More recently, several studies have documented that situations associated with greater mind-wandering reports (as assessed outside of the scanner) also lead to greater activity in many of the key elements of the DMN (Mason et al. 2007; McKiernan et al. 2006).

While activity in the DMN is correlated with high probability of retrospective reported mind-wandering, it was originally unclear whether particular episodes of self-reported mind-wandering are linked to recruitment of the DMN. To assess whether this was the case, we conducted a study in which experience sampling was combined with fMRI to assess the neural activity that occurred during particular episodes of mind-wandering (Christoff et al. 2009). This study revealed that, in addition to the activation of several core structures in the DMN, areas normally observed in controlled processing (including the dorsolateral prefrontal cortex and the dorsal anterior cingulate) were also engaged during self-reported off-task thought. This pattern of brain activation suggests that executive and default network resources are jointly recruited during episodes of mind-wandering. One possible account explaining this joint activation is that executive network resources play a role in transforming the self-referential content supported by the DMN into the internal train of thought that we experience when the mind wanders. Further support for this hypothesis is provided by evidence that the ability to engage in autobiographical planning (such as "how do I get out of debt?") requires cooperation between the DMN and a system involving attentional control (Spreng et al. 2010).

Christoff et al. (2009) also compared the pattern of activations associated with introspective reports of mind-wandering, on the one hand and the pattern of activations associated with behavioral errors, on the other hand. Although a variety of factors are known to contribute to behavioral errors during the SART, mind-wandering is believed to be one important source of such errors. Consistent with this view, SART errors (Figure 9) and the introspective reports of mind-wandering (Figure 10) were associated with similar patterns of brain recruitment, providing further validation for the use of introspective experience sampling reports for the study of mind-wandering.

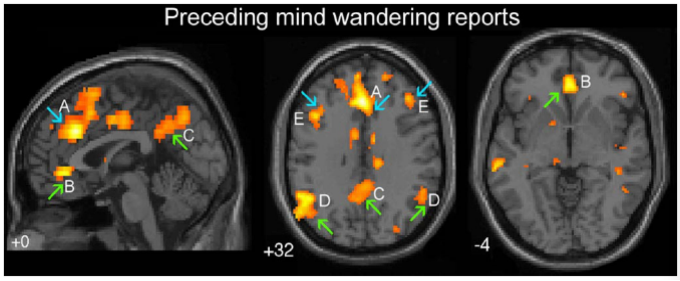

Figure 9: Activations preceding reports of mind wandering (off-task versus on-task). Upward green arrows: default network regions; downward blue arrows: executive network regions. Regions of activation included (A) Dorsal ACC (BA32); (B) Ventral ACC (BA 24/32); (C) Precuneus (BA7); (D) Left temporoparietal junction (BA 39); (E) Bilateral DLPFC (BA 9). Height threshold $P<0.005$, extent threshold $k>5$ voxels (from Christoff et al. 2009).

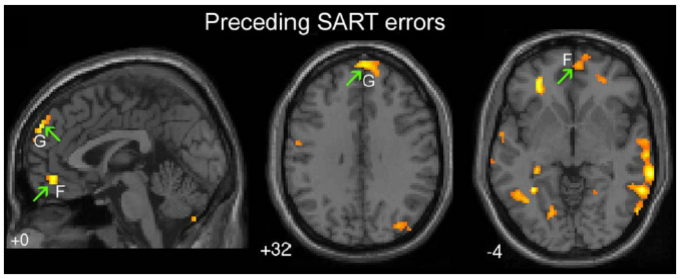

Figure 10: Activations preceding SART errors (interval prior to incorrect versus correct targets). Upward green arrows: default network regions; downward blue arrows: executive network regions. Regions of activation included: (F) Ventromedial PFC (BA10/11); (G) Dorsomedial PFC (BA9). Height threshold P<0.005, extent threshold k>5 voxels (from Christoff et al. 2009).

3.3.2 The intermittent meta-awareness of mind-wandering: How susceptible is mind-wandering to temporal dissociations?

Although when queried individuals are quite reliable in their capacity to self-report whether or not they were mind-wandering, a variety of strands of evidence suggest that people routinely fail to spontaneously notice when mind-wandering takes place. Two paradigms, reviewed earlier, have documented the intermittent meta-awareness of mind-wandering.

3.3.2.1 Self-caught/probe-caught methodology

One approach for documenting mind-wandering in the absence of meta-awareness is combining self-catching and experience sampling measures into a single paradigm. Recall that the self-catching measure asks participants to press a response key every time they notice for themselves that they have been mind-wandering. This measure provides a straightforward assessment of the mind-wandering episodes that have reached meta-awareness. The experience sampling measure, on the other hand, randomly probes people regarding whether they were at that particular moment mind-wandering. When used in conjunction with the self-caught measure, experience sampling can catch people mind-wandering before they notice it themselves.

A number of studies have effectively used the self-caught/probe-caught methodology to illuminate the relationship between mind-wandering and meta-awareness. This approach was initially used to examine mind-wandering while reading (Schooler et al. 2004) and revealed that whereas participants regularly caught themselves mind-wandering, they nevertheless were often caught mind-wandering by the probes. Strikingly, and in support of a fundamental difference between mind-wandering episodes that are accompanied by meta-awareness and those that are not, there was a strong correlation between probe-caught mind-wandering and comprehension performance but no such relationship between self-caught mind-wandering and comprehension.

Additional studies have examined the impact of two mind-altering experiences hypothesized to undermine individuals' meta-awareness: alcohol intoxication and cigarette craving. In one study (Sayette et al. 2009), social drinkers consumed a moderate dose of alcohol or a placebo beverage and then performed a reading task (implementing a self-caught/probe-caught mind-wandering assessment methodology). Compared with those who drank the placebo, participants who drank alcohol were more likely to report that they were "zoning out" when probed. After accounting for this increase in mind-wandering, alcohol also lowered the probability of catching oneself zoning out (i.e., self-catching). These data suggest that alcohol increases mind-wandering while simultaneously reducing the likelihood of noticing one's mind-wandering.

In another study (Sayette et al. 2010), smokers, who were either nicotine-deprived (crave condition) or non-deprived (low-crave condition), performed the same mind-wandering task used in Sayette et al. (2009). Smokers in the cigarette-crave condition were significantly more likely than the low-craving smokers to acknowledge that their mind was wandering when they were probed. When this more-than-threefold increase in zoning out was accounted for, craving also lowered the probability of catching oneself mind-wandering. Similar to the alcohol consumption findings, it appears that ci-

garette craving simultaneously increases mental lapses while reducing the metacognitive capacity to notice them.

3.3.2.2 Retrospective classification of mind-wandering episodes

A second methodology that has been used to examine fluctuations in meta-awareness of mind-wandering entails combining the experiential sampling methodology with a judgment of participants' immediately prior state of awareness. Recall that, in the experience sampling procedure, participants are intermittently queried regarding whether or not they were mind-wandering; in this combined approach, if they report mind-wandering to the probe, then they are also asked to indicate if they were aware that they were mind-wandering. In response to such queries, participants routinely indicate that they had been unaware of their mind-wandering up until the time of the probe. Moreover, when participants classify mind-wandering episodes as unaware, their performance and neurocognitive activity systematically differ from when they report having realized they were mind-wandering.

Consistent with findings using the self-caught/probe-caught methodology, retrospective classifications of unaware mind-wandering episodes (termed zoning out) and aware episodes (termed tuning out), indicate that the former are more associated with comprehension failures than the latter (Smallwood et al. 2008). By contrast, reports of zoning out seem to be most closely linked to failures in response inhibition (Smallwood et al. 2008, 2007) and to poor mental models during reading (Smallwood et al. 2008). Together these results suggest that while maintaining streams of stimulus-independent thought interfere with the integrity of external attention, the absence of awareness of mind-wandering is especially damaging to task performance.

Neurocognitive measures also reveal differences in the degree of activation between mind-wandering episodes that have been classified as aware versus unaware. In the combined experience sampling/fMRI study conducted by Christoff et al. (2009), mind-wandering with awareness activated similar brain regions to those observed during mind-wandering without awareness. These brain regions, however, were more strongly activated when mind-wandering occurred without awareness (see Figure 11). The anterior prefrontal cortex (BA10) was one of the brain regions significantly more strongly recruited during unaware episodes of mind-wandering. Notably, anterior prefrontal cortex (PFC) recruitment has been directly linked to engagement of cognitive meta-awareness (McCaig et al. 2011). The observation that this same brain region became specifically more recruited during unaware episodes of mind-wandering may seem surprising at first. However, the anterior PFC may be involved in mind-wandering through its role in the maintenance of thought. As discussed further below, its recruitment during mind-wandering in the absence of awareness may make it more difficult for meta-awareness to be implemented.

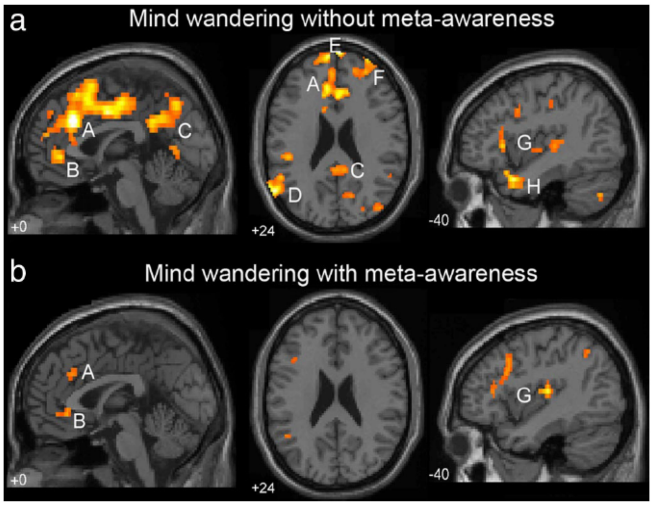

Figure 11: Mind-wandering in the (a) absence and (b) presence of meta-awareness. (a) Regions of activation associated with mind-wandering in the absence of awareness (off-task unaware versus on-task): (A) Dorsal ACC (BA32); (B) Ventral ACC (BA32); (C) Precuneus (BA7); (D) Posterior Temporoparietal Cortex (BA39); (E) Dorsal Rostromedial Prefrontal Cortex (BA10); (F) Right Rostrolateral Prefrontal Cortex (BA10); (G) Posterior & Anterior Insula; (H) Bilateral Temporopolar Cortex; (b) Similar regions were activated during mind-wandering with awareness (off-task aware versus on-task comparison) but to a lesser degree, including: (A) Dorsal ACC (BA32); (B) Ventral ACC (BA24/32); (G) Posterior & Anterior Insula. Height threshold $P<0.005$, extent threshold $k>5$ voxels (from Christoff et al. 2009).

3.3.3 Summary

In sum, the investigation of mind-wandering from the vantage of the distinction between having an experience (experiential consciousness) and explicitly realizing that one is having an experience (meta-awareness) has provided a fertile ground for developing a third-person understanding of first-person experience. This research has begun to chart the stream of consciousness, demonstrating that individuals regularly vacillate between the outer realm of perception and the inner realm of thoughts and feelings. This fluctuation routinely evades explicit meta-awareness, enabling people's minds to move on to a new topic without explicitly realizing this fact. Nevertheless, when directly queried, people are remarkably capable of introspecting and noticing whether or not they were mind-wandering. The fluctuation of perspectives on the mind that this approach affords raises numerous questions. Here, I address three: 1) If people are so competent at recognizing that they are mind-wandering when queried, then why do they find it so difficult to notice this fact on their own? 2) Are there ways of enhancing the capacity to catch one's mind in flight? 3) What are the implications of this approach for the more general enterprise of the science of first-person perspective? I consider these questions in turn.

3.3.3.1 Why is mind-wandering so easy to report but so difficult to catch?

The observation that meta-awareness is so effective at discerning mind-wandering when queried about it, yet so poor at catching it on its own, raises the natural question of why this discrepancy exists. Two potentially interrelated explanations may contribute to this striking discrepancy.

Like mind-wandering, meta-awareness appears to be associated with rhythms of attentional flux (Schooler et al. 2011). Sometimes we are explicitly aware of our mental states, and other times we are not. Such vacillations in meta-awareness could readily contribute to individuals' frequent tendency to overlook episodes of mind-wandering, as this mental state may only be notable when the explicit spotlight of attention is metaphorically turned on itself. Indeed the tendency to only notice mind-wandering after the fact may similarly apply to other mental states that routinely curtail the occurrence of meta-awareness. Like mind-wandering, other subjective states such as sleep, anesthesia, dreaming, and flow states are typically not noticed while they are occurring, but are readily acknowledged after the fact. Sleep (in the absence of dreaming) and anesthesia are typically lacking conscious experience entirely and so clearly are not candidates for meta-awareness. The mental states associated with gradually drifting off to sleep and dreaming do have phenomenal content but typically lack meta-awareness. This is why people routinely don't notice that they are falling asleep (a grave danger for driving) or dreaming (except in the case of lucid dreaming, LaBerge 1980). Another example is that of flow states (Csikszentmihalyi 1988), during which people engage in highly demanding tasks at close to their optimum level of performance. In such cases, people lack the additional resources to take stock of their experience, which may be why meta-awareness of a flow state often leads to its sadly premature termination. Nevertheless, as in the other cases, after a flow state has ended, individuals are quite able to acknowledge its occurrence. In all of these cases, the common denominator may be that these various states (for one reason or another) curtail the occurrence of meta-awareness, and thus are only noticed after the fact once the opportunity for meta-awareness reoccurs.

One reason why mind-wandering may undermine meta-awareness may stem from its reliance on the very same brain regions that may be necessary for noticing its occurrence. A striking aspect of the brain regions associated with mind-wandering is that they involve many of the systems that might be expected to contribute to the monitoring of the state. For example, elements of the medial prefrontal cortex are recruited both during mind-wandering and in tasks that require theory of mind (Gallagher & Frith 2003). As mental state attribution involves the application of meta-cognitive pro-

cesses to information of a stimulus-independent nature (e.g., inferences about the mental state of another individual), the engagement of these brain regions during mind-wandering could prohibit their utility in the service of catching the wandering mind. Similarly, in the combined fMRI/experience sampling study conducted by Christoff et al. (2009), periods of mind-wandering engaged regions such as the dorsal ACC, involved in error-detection and conflict monitoring, and the anterior PFC, involved in cognitive meta-awareness. If mind-wandering engages both meta-cognition and error-detection systems in the service of generating a coherent stream of stimulus-independent thought, the fact that these systems are already engaged may make them less capable of detecting a mind-wandering episode. The observation that mind-wandering and meta-cognitive processes both engage the same systems does not necessarily establish a causal relationship between these two. Nevertheless, it remains an intriguing speculation that our persistent failure to catch ourselves mind-wandering may occur because mind-wandering hijacks the precise meta-cognitive brain regions that are necessary for noticing it. Future research might profitably explore this hypothesis by examining whether mind-wandering episodes that are experimentally induced to emphasize meta-cognitive reflection are particularly likely to evade detection.

3.3.3.2 Are there ways of enhancing people's awareness of their mind-wandering?

One of the clear findings of research on mind-wandering is that it can be extremely disruptive to performance. Reading (Smallwood et al. 2008), working memory (McVay & Kane 2009), vigilance (Cheyne et al. 2009), and general intellectual functioning (Mrazek et al. 2012) can be seriously disrupted by mind-wandering, especially when it occurs without awareness (Smallwood et al. 2008). This raises the natural question of whether enhancing people's meta-awareness of their minds can help to curtail the disruptive consequences of mind-wandering.

Of course, just because episodes of mind-wandering routinely end with a moment of meta-awareness ("shoot, I drifted off again") does not mean that the meta-awareness necessarily was responsible for its ending (Schooler et al. 2011). Meta-awareness could be a consequence rather than the source of the termination of a mind-wandering episode. According to this view, the intuition that meta-awareness terminates mind-wandering episodes is another example of an over-reach of the attribution of deliberate intention (Metzinger 2013). While this remains a viable possibility, it is also the case that mindfulness techniques aimed at enhancing awareness of one's internal states can curtail the negative effects of mind-wandering.

In one study (Mrazek et al. 2013), participants were randomly assigned to one of two interventions that they were told were expected to enhance their performance: two weeks of training either in mindfulness meditation, or in good nutrition practices. Both interventions involved similar time commitments, expectations, and homework (either daily mediation or a nutrition journal). Before and after the intervention, participants were given both reading comprehension and working memory tasks, and their mind-wandering during each was assessed. Compared to the nutrition control, the mindfulness intervention significantly reduced mind-wandering, improved performance on both tasks, and these benefits were mediated by the reduction in mind-wandering for those who were high in mind-wandering to begin with. These findings dovetail with other recent studies indicating that the general tendency for mindfulness (being present in the moment) is negatively correlated with mind-wandering (Mrazek et al. 2012), and that even a simple mindfulness exercise conducted with non-meditators (focusing on one's breath for eight minutes) can temporarily reduce mind-wandering (Mrazek et al. 2012).

Although research on the impact of mindfulness training in dampening mind-wandering is consistent with the notion that part of its efficacy is due to enhancing meta-awareness, there is one finding that does not completely square with this account. Specifically, Mrazek et al. (2012) found that mindfulness training re-

duced people's tendency to spontaneously notice mind-wandering episodes. However, this reduction in self-caught mind-wandering could have occurred because the mindfulness practice enhanced people's awareness of the focus of their attention, thereby preventing them from initiating mind-wandering episodes in the first place. Consistent with this speculation, another recent study (Baird et al. in press) demonstrated that a similar mindfulness program can enhance at least one meta-cognitive skill, namely, the ability to assess the accuracy of memory recognition judgments. Although more research is clearly needed, it remains quite plausible that one mechanism by which mindfulness training reduces mind-wandering is by increasing people's meta-awareness of when their minds are beginning to wander.

3.3.3.3 What are the implications of this approach for the more general enterprise of the science of first-*person* perspective?

The program of research outlined above demonstrates the insights into first person experience that can be gleaned by assessing it from a third-person perspective. In many respects, the approach described here exemplifies the program of heterophenomenology that Dennett advocates. We are systematically assessing people's reports about their conscious experiences while explicitly acknowledging that those reports correspond to people's beliefs about their experience (i.e., their meta-awareness) and not necessarily their actual experience. However, by using various reasonable markers of people's internal states we have been able to examine the conditions under which people's reports are more or less likely to be aligned with their experience. In this regard, we find that when people are explicitly asked whether they were just mind-wandering, their self-reports align with a host of behavioral and physiological measures that should co-vary with mind-wandering. These findings suggest that people are quite accurate in retrospectively assessing whether or not they were just mind-wandering. In other words, by triangulating between people's retrospective self-reports of mind-wandering (following experience sampling cues) and both behavioral and physiological measures, we have identified situations in which all evidence suggests that people's opinions about the content of their private experience is generally quite accurate.

At the same time, by introducing the self-caught procedure in combination with retrospective assessments of people's awareness of prior states of mind-wandering, we have also documented critical lacunae in people's knowledge of their mental states. Specifically we find that people routinely fail to spontaneously notice when their minds have wandered. When tasked with reporting mind-wandering whenever they become aware of it, people routinely demonstrate behavior indicative of mind-wandering while failing to report it. If they are probed during periods in which these measures suggest they are mind-wandering, they routinely indicate that they now realize that they were mind-wandering, but they had not noticed this state until the time of the probe. We are thus also able to identify situations in which all evidence suggests people are routinely lacking in their current knowledge of their ongoing mental state.

By triangulating between people's first-person reports and multiple other third-person measures we have begun to reveal the relationship between people's beliefs about their experience and empirical indices of their underlying mental states (for related approaches, see Hurlburt & Heavey 2001; Jack & Roepstorff 2002; Lambie & Marcel 2002; Lutz & Thompson 2003). Moreover, the theory of the intermittent and imperfect nature of meta-awareness as a re-representation of experience (Schooler & Schreiber 2004; Schooler 2002; Schooler et al. 2015) provides a scaffold for conceptualizing the situations in which beliefs and underlying experience converge and diverge. Of course, one could always counter that we cannot be sure that the variety of behavioral and physiological measures that correlate with self-reported mental states such as mind-wandering are necessarily indicative of those states. Perhaps there is some third variable that is responsible for both mind-wandering and the host of measures that

we find to be correlated with people's self-reporting of it. But it seems a stretch to suggest that this entirely unknown third variable could account for why, when people say they were mind-wandering, their performance on primary tasks is impaired, their eye movements become less sensitive to what they are looking at, their physiological measures indicate a dampening of attention to external processes, and their brain activation corresponds to that which occurs when they are unoccupied. In short, a strong case can be made for the value of using empirical third-person science to inform not only our understanding of people's beliefs about their experience, but also to discern when those beliefs are likely to be accurate and when they may be inaccurate or incomplete.

It seems likely that those with strong allegiances to either an exclusively first- or third-person account of experience will balk at the notion that third-person empirical indices can be used to corroborate people's first-person accounts. Traditional phenomenologists (e.g., Husserl 1963) may contend that first-person experience is privileged and so, when discrepancies arise between it and third-person data, that the former should invariably be favored. Those with a behaviorist bent may argue that making claims about underlying subjective states remains a dead end because ultimately they can never truly be verified. Personally I find myself sympathetic to both of the vantages; however, I argue that the striking disparity of these views, both from each other and from the one promoted here, stems from the incongruence that naturally arises from shifting perspectives.

From the vantage of one perspective of a Necker cube, the alternative perspective makes little sense. When the spinning dancer is moving in one direction, it is hard to imagine how she could possibly shift directions. Those who have never entered the third dimension of a Magic Eye image could reasonably doubt that such a perspective could possibly exist. But once one realizes that there are distinctly different perspectives to be had on a situation, and that these alternative perspectives each offer their own valuable vantage, then that knowledge can be held even as one remains incapable of experiencing both at the same time. I believe this is the case with interpreting scientific third-person accounts of first-person experience. If one is capable of recognizing both the strengths and limitations of each perspective, then they can use each to inform the other. If, however, they solely look at a problem from one or the other perspective, then this may lead to a logically consistent view, but one that omits an important vantage. I turn now to a consideration of this larger issue: namely, conceptualizing a meta-perspective that can accommodate the vacillating manner in which first-person experience is both that which we know best and understand least.

4 Toward a meta-perspective for considering the metaphysics of first- versus third-person perspective

It is my contention that debates about how to reconcile the first- and third-person perspective on reality arise in part from the distinct vantages that different scholars take on the issue. The problem in a nutshell is that while the prevailing third-person perspective of science (material reductionism) does an admirable job of accounting for all aspects of reality that are revealed from its vantage, it robustly fails to accommodate several self-evident aspects of existence that are uniquely apparent from a first-person perspective. If one simply dismisses those aspects of the first-person perspective that are incongruent with the third-person perspective, (as most scientists and many philosophers do), then there is no problem. However, here I will argue that there exist self-evident observations derived from the first-person perspective that are as compelling as any objective fact. Such observations should not be simply dismissed as irrelevant or illusory but rather suggest the need of serious revision to current accounts of physical reality (for related arguments see Chalmers 2002; Nagel 2012). In the following section, I first review the material reductionist account suggested by the prevailing third-person perspective view. I then consider several elements of existence revealed by a first-person perspective that seem to have no place

in this account, most notably subjective experience, the flow of time, and the distinctiveness of the present. Finally, I offer some speculative remarks about the nature of a meta-perspective that might be able to accommodate both vantages.

4.1 Ontological third-person perspective—Material reductionism

When reality is conceived of strictly from the vantage of a third-person perspective, it quite naturally leads to the premise of material reductionism, namely that everything including the arising of subjective experience can be accommodated on the basis of physical principles that do not themselves make any appeal to consciousness. This account is arguably the prevailing view among both scientists (e.g., Crick 1994; Bloom 2009; Graziano 2013) and philosophers (e.g., Dennett 1993; Churchland 1989; Metzinger 2004). Its strength comes from its remarkable record of success. Having abandoned the superstitions and spiritual whimsies of the past, hard-nosed science has an amazing track record for explaining everything it has been directed toward with purely physical constructs. Aspects of reality that were once thought to be beyond the ken of the third-person perspective of science, for example the notion of some sort of mystical force of life, élan vital, have been reduced to rigorous formalisms (e.g., DNA code). Admittedly, we do not currently have a full accounting of how it is that we experience a first-person perspective on reality, but given science's track record, it is presumed to be merely a matter of time before these experiences are explained with precisely the same type of accounts that have been used so successfully to explain so much so far (Churchland 1989). People may feel as if they have some type of privileged perspective, as if the view from within their own minds could never be reduced to and explained by the machinations of atoms, but this is just shortsightedness, perhaps fueled by some evolutionary advantage to view mind and matter as different (Bloom 2009).

There is much to be said for material reductionism, as it draws on the very assumptions that have led to the remarkable progress of science. To appeal to the existence of some other distinct realm of reality beyond the objectively physical smacks of ghosts and fairy dust (e.g., Jackson 1982). To date, while the previous analysis has revealed the marked advances to our understanding that emerge when we consider people's first-person perspectives, no *explanation* in science has required abandoning an exclusive reliance on mutually verifiable third-person observations. In other words, although I will soon suggest cases that may challenge this tradition, to date there are no third-person accounts of physical phenomena that have been undermined solely because they conflict with first-person experience. Given the track record of third-person accounts, it may seem hard to justify why one scientific question (the arising of conscious experience) should challenge an ontological perspective that is not problematic for anything else.

4.2 Ontological first-person perspective—What material reductionism leaves out

Although material reductionism provides an outstanding vantage for accounting for the physical world, it comes up wanting when the mind is inspected from a first-person perspective. The essential challenge is that even if a materialistic explanation is able to account for how the mind functions, this does not explain how it is that there is a subjective experience associated with it, or why that experience is as it is. As Jackson (1982) puts it:

> Tell me everything physical there is to tell about what is going on in a living brain, the kind of states, their functional role, their relation to what goes on at other times and in other brains, and so on and so forth, and be I as clever as can be in fitting it all together, you won't have told me about the hurtfulness of pains, the itchiness of itches, pangs of jealousy, or about the characteristic experience of tasting a lemon, smelling a rose, hearing a loud noise or seeing the sky. (p. 127)

Jackson introduces the canonical example of Mary the color scientist to illustrate this point. Imagine that Mary is a color scientist who has been brought up in a black and white room and has never experienced red; nevertheless, she knows all there is to know about the physical processes relevant to color vision. Jackson's point is that if she later experiences red firsthand, she will learn a new fact (the experience of red) that all of her physical knowledge was insufficient to provide. Complete physical knowledge about a subjective experience is insufficient to entirely know all there is to know about that experience. One has to actually have the first-person experience to fully understand it.

A second criticism of material reductionism involves its inability to explain the arising of conscious experience. It is quite straightforward to imagine how physical processes could account for the structure and function of the mind in much the same way that they can explain the structure of computer hardware and the functions of computer software. But such an account would not explain how subjectivity itself arises or what it is like from the vantage of the experiencer. Similarly, even if we were to create a computer that perfectly emulated a conscious being, we could not know whether it was genuinely conscious, and if it were, "what it is like to be" (Nagel 1974) a computer.

The inherent difficulty of conceptualizing how material objects enjoy subjective experience is further illustrated by a third criticism of material reductionism, namely that it is possible to conceive of a system that has all of the physical characteristics of a conscious being, but nevertheless lacks consciousness. Philosophical zombies (Chalmers 1995) are hypothetical human beings who have no internal experience but are otherwise identical to normal people in all other physical measurements and behaviors (including claiming that they are conscious). Although there is no way of demonstrating that such creatures could ever exist, there is also no way of demonstrating that they couldn't. Finding the neural correlates of consciousness helps not an iota, as even a zombie who reported consciousness in certain brain states would still not be actually enjoying a genuine experiential state. If zombies that are physically indistinguishable from experiencing humans could in principle exist, then there is nothing inherent in what is known about physical systems that speaks to the arising of consciousness. This presents a major problem to the prevailing material reductionist view because it offers no way to distinguish between philosophical zombies and the non-zombies.

The essential problem of the exclusively third-person perspective of material reductionism is that it is forced to ignore all aspects of experience that cannot be reduced to a third-person perspective. A thought experiment may help to provide a further "intuition pump" (Dennett 2014) for illustrating just how special that extra something might be. Consider the following science fiction variant on the classic Faustian bargain (Goethe 1867). One day, to your amazement, a flying saucer lands in front of you and a member of a clearly more advanced species emerges and says that he/she (it's unclear) has been enjoying our debates about the mind-body problem, which his/her civilization has solved. If philosophical zombies are logically[3] possible, you can be turned into one. He/she offers you all the gold you can imagine (they've also mastered alchemy) if you are willing to accept the risk of becoming a zombie. If a zombie is a logical possibility, you will be transformed into one. From everyone else's perspective (i.e., the third-person perspective), you will be exactly as you were before (just much richer). However, you will not actually have any experience at all; you will simply seem to others as if you do. Would you take the bargain? Hard-nosed material reductionists say they would (D. Dennett, personal communication, 7/15/2014; M. Graziano, 6/10/2014, personal communication), but many of the rest of us might not. What is the value of untold wealth, if there is no inner experience by which it can be enjoyed?

The *Zombie Faustian Bargain* serves as a useful intuition pump for illustrating the im-

3 Let's just assume, for the sake of argument, that the aliens had solved the tricky issue of moving from logical to nomological possibility, that is that if it is possible for a philosophical zombie to exist in any conceivable universe, that it would be possible for you to become one.

portance of the extra something that is left out of the third-person material reductionist perspective. Nevertheless, it is clearly a fanciful proposition and material reductionists might reasonably argue that there is not much to worry about if the only cost to adopting their view is not knowing how to respond to such an unlikely scenario. However, there are numerous other examples closer to home where the limits of a third-person accounting of consciousness become relevant. Issues surrounding the nature and existence of consciousness in other species, fetuses, and computers all revolve around inferences about first-person experiences that gravely exceed all known or conceived ways of reconciliation.

A less obvious domain for a clash between the current prevailing third-person perspective of science and first-person experiences arises in, of all places, physics. Although there has been some speculation, now largely disregarded by the mainstream, that consciousness could have something to do with the collapse of the wave function in quantum physics (Wigner & Margenau 1967), in general, consciousness is assumed to have little relevance to physics. However, there are two current assumptions in physics that seem to squarely contradict first-person experience. Specifically, physicists believe that the flow of time is an illusion and that there is nothing special about the present. Before considering why these claims are so problematic for the existence of subjective experience, let us first consider why physics makes this claim.

4.3 Why physicists dismiss the flow of time and the privileged present

In considering the nature of time, physicists often "spatialize" it. In other words, they attempt to place it on a similar footing to the traditional three dimensions of space (see Figure 10). Though differing from spatial dimensions in important respects (Einstein 2001), the notion of time as similar to a spatial dimension is a key feature of the prevailing Einstein/Minkowski interpretation of special relativity theory. Space and time are combined in this theory into one concept: space-time. The spatialization of time allows the depiction of a "block universe" in which the traditional spatial dimensions are reduced (for purposes of visual illustration) to two dimensions from three, and time is added as a third dimension. Such a depiction can be thought of as a space-time "loaf of bread," where each narrow cross- section of the loaf ("slice") constitutes a moment in time of the entire universe. According to the block universe view (widely held by today's physicists), all slices—past, present, and future—already exist. This arises from the relativity of simultaneity, which means that "now" is different for different observers. It is simply that each individual observer is privy to only one moment (slice) at a time. From the vantage of a block universe, the only thing that seems to actually move in time is consciousness itself (i.e., the observer). This means that from the vantage of the prevailing view of physics, the flow of time is not a part of objective reality but simply an artifact of subjective experience. As Stanford physicist Linde (2004) notes: "Thus we see that without introducing an observer, we have a dead universe that does not evolve in time" (p. 25). What is more, once we conceive of the temporal dimension as the equivalent of another spatial dimension, then there are not enough degrees of freedom for the observer to move in time; that is, movement requires a rate in time, but time in the block universe is already represented as a spatial dimension, and thus cannot also be used as the metric that establishes the rate of movement through time. As the physicist Paul Davies (2002) puts it:

> Nothing other than a conscious observer registers the flow of time. A clock measures durations between events much as a measuring tape measures distance between places; it does not measure the 'speed' with which one moment succeeds another. Therefore it appears that the flow is subjective, not objective. (p. 36)

The upshot of this reasoning is that the flow of time is an illusion, an artifact of consciousness. Again, as Davies (2002) puts it: "From the fixed past to the tangible present to the undecided

future, it feels as though time flows inexorably on. But that is an illusion" (p. 32).

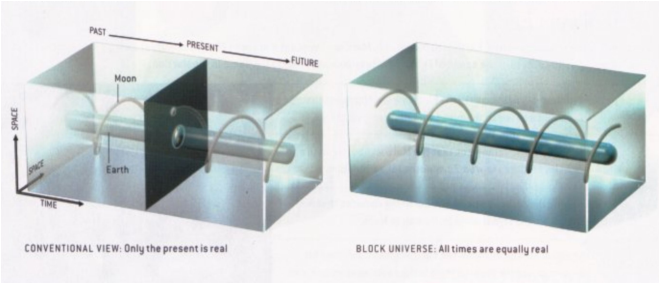

Figure 12: Although the conventional view derived from experience is that the present is real and moves through time, current views in physics say this is erroneous. According to the standard block universe view in physics, all moments—past, present, and future—are equally real. The flow of time and the privileged present are seen as illusions of consciousness (from Davies 2002).

The characterization of reality as a block universe, with the flow of time as an illusion of consciousness, also leads to the conclusion that the privileged present is an illusion. One of the most pronounced aspects of consciousness is its extension in time. Consciousness extends in time and thereby gains the "now" in which it resides. First-person observers may remember the past or imagine the future (as often happens during mind-wandering) but ultimately mental time travel always takes place in the present. The observer perpetually and exclusively resides in the present. In this sense, it seems intuitively self-evident that the "now" is privileged. But not so from the current vantage of the block universe in physics, where the present is treated exactly the same as the past and the future. As Einstein himself observed, "The past, present and future are only illusions, even if stubborn ones" (quoted in Hoffmann & Dukas 1972, p. 258). Again, the problem is that the only thing that defines the present from the vantage of a block universe is that it is where the observer perceives itself to be at any particular moment in time. But from the vantage of a block universe, all moments of time exist simultaneously.

The notions that the flow of time and the privileged present are merely illusions of consciousness are less problematic from a third-person perspective than the first-person perspective. If there is no ultimate reality to subjectivity, then there is no problem making claims that are directly in opposition to subjective experience. At a recent public lecture, I asked the noted physicist Brian Greene how he reconciled physics' static view of nature with the self-evidently dynamic experience of consciousness. His reply was that he "sees a psychiatrist," that consciousness is capable of all sorts of illusions, and that the flow of time is just another example of the artifacts of consciousness.

While as detailed in the earlier section of this paper, I am the first to concede that our first-person reports can be fallible, as consciousness is capable of all sorts of illusions, it is hard for me to conceive of how consciousness could create an illusion of the flow of time, or the privileged present. There are several reasons why I am skeptical of this claim. First, just as matter must have extension in space in order to exist, so too it seems that consciousness must have extension in time. If consciousness had no "thickness" in time, then I simply do not understand how it could exist any more than an object could exist without some extension in space. Time is the dimension in which consciousness extends. Although the objective duration of the specious present (James 1918) may be rather modest (Pöppel 1997) without at least some extension in time I do not see how there can be any consciousness at all. Second, my experience is defined in terms of the flow of time and a privileged present; the stream of my consciousness is essentially a succession of "nows," with the present always entailing the bridge between the past now and the future now. In a nutshell, from my first-person perspective I find the reality of the flow of time and the privileged present as compelling as the existence of physical reality itself (which also could in principle be an illusion, Descartes 1641/1996).

4.4 Reconciling first- and third-person perspectives of reality

Those who subscribe to a strict material reductionist perspective insist that when first-person experience suggests characteristics of reality

that are not readily handled by a third-person account, that those aspects must be rejected. From a strict materialist perspective, the seemingly privileged knowledge afforded by subjective experience, the flow of time, and the unique significance of the present all must be disregarded as illusions of consciousness. But herein lies the rub. The third-person perspective on reality is adequate as long as it provides constructs that correspond to the core aspects of the first-person perspective. However, when that perspective requires me to abandon absolutely fundamental aspects of my experience, then I am forced to question the assumptions that impose that requirement.

Whether we acknowledge it or not, all of us must discern for ourselves what aspects of existence to take as axiomatic. By definition, axioms cannot be empirically proven or logically deduced, rather they are self-evident truths that must be taken as givens. Perhaps the most fundamental of all such axioms is that physical reality exists; i.e., that I am not residing in a solipsistic mirage. Ultimately, while I grant the ontological reality of the physical world, in an important sense I am less epistemologically certain of it than I am of partaking in subjective experience. Ultimately, the only thing that I can know with absolute confidence is that I am currently enjoying a first-person experience (Descartes 1996). Physical reality could be a dream, I could be a brain in a vat or the matrix, indeed even my past could be an illusion, but there is simply no question but that I am currently having an experience. It might be an illusory experience[4], but even an illusory experience is still experienced. Thus, although it is conceivable that physical reality could be an illusion, it is inconceivable (at least to me) that the occurrence of my subjective experience could be entirely baseless. This leads me to conclude that the existence of subjective experience and all premises that necessarily underpin its existence must be treated on equal ontological grounds to that of physical reality. Accordingly, if we grant subjective experience an ontological status equivalent to that of objective reality then we must seriously question any characterization of objective reality that challenges the essential qualities of subjective reality. While much of our subjective experience may be an illusion, it is very difficult to see how the privileged vantage of subjective experience, the flow of time, or the unique status of the present could be such. To quote the philosopher David Ray Griffin (2007): "The reality of time is a more fundamental and stubborn fact than the alleged facts on which its denial is based" (p. 119).

A variety of approaches has been offered to accommodate the seeming limitations of a purely physical accounting of consciousness. Idealism (Berkeley 1878; Goswami 1993; Hoffman 2008) responds to the seemingly superior ontological status of subjective experience (i.e., its existence is more certain than an inferred external reality) by suggesting that if one must be reduced to the other, then it should be physical reality that is seen to be an outgrowth of subjectivity, rather than the other way round (as the material reductionists contend). Although difficult to refute, idealism (at least in the macro sense of conscious beings creating reality with consciousness) appears to discount the independent existence of a natural world, and thus seems at odds with a scientific vantage.

Another approach for reconciling the seemingly incommensurate existence of the subjective and objective is to pose that they both exist as two interacting yet distinct realms. This approach (substance dualism) was favored by Descartes, but it has a serious logical deficiency (at least as originally formulated): if two realms are truly incommensurate and distinct, then there seems to be no way for them to interact. To posit a "ghost in the machine" (Ryle 2009) is to assume that the ghost can affect the machine, which means that they share some common ground and therefore are not entirely distinct realms. This difficulty has proven a major problem for substance dualism (Armstrong 1999), although see Chalmers (2002) for arguments as to why the challenge of understanding the causal nexus between the mental and physical is not unlike similar issues of causality observed within the physical realm.

4 An illusory experience being defined as an experience that does not correspond to actual reality, such as a hallucination. Note that a philosophical zombie does not have an illusory experience of being conscious, it has no experience at all.

In my view, the seeming impasse between the third- and first-person perspectives of reality strongly suggests the existence of some other meta-perspective that can accommodate them both. Like the reversible images that can initially invoke one of two entirely opposed interpretations, but that can subsequently be reconciled from a vantage that recognizes the reality of both, (even if they cannot be both apprehended simultaneously) so too it seems there must be some meta-perspective for reconciling first- and third-person vantages on reality. In other words, it seems likely that there exists a higher order outlook that simultaneously acknowledges the manner in which neither perspective can simply be reduced to the other, yet still offers a mode of resolution. It is clearly easier to recognize the need for a meta-perspective than to identify precisely what such a view might be. Nevertheless, it seems a goal well worth pursuing.

Over the years, a number of scholars have tried their hand at envisioning a vantage that neither tries to reduce the subjective to the physical, nor the physical to the subjective, but rather conceives of some common ground or property that may be reflective of both. This approach, often referred to as neutral monism (Chalmers 2002; Feigl 1958; James 1904; Russell 1927), though with close affinities to dual aspect theories (e.g., Jackson 1982; Nagel 1986; Spinoza 1677/1985; Velmans 2009), attempts to identify a neutral realm of existence that can be alternately characterized as mental, physical, or neither.

The ever-changing present represents a core element of the common ground between subjectivity and objectivity that is invoked in several accountings of neutral monism. For William James, the neutral realm was the present:

> The instant field of the present is at all times what I call the 'pure' experience. It is only virtually or potentially either object or subject as yet. For the time being, it is plain, unqualified actuality, or existence, a simple that. (1904, p. 23)

For Bertrand Russell, the neutral realm was the event: "Everything in the world is composed of 'events.'... An 'event,' as I understand it ... is something occupying a small finite amount of space-time." For Alfred North Whitehead (1929), the present also served as the nexus of conjunction between the objective and the subjective. In Whitehead's panpsychic characterization of reality, the interface between first- and third-person perspectives occurs in the "creative advance" of the present in which time marches forward in a continual alternation among all elements of reality between subjective and objective states (for further discussions of Whitehead's account, see Griffin 2007; Hunt 2011).

Information represents a second element that unites several efforts to find the neutral realm from which both subjectivity and objectivity arise. As Chalmers (1996) observes:

> Perhaps, then, the intrinsic nature required to ground the information states is closely related to the intrinsic nature present in phenomenology. Perhaps one is even constitutive of the other. That way, we get away with a cheap and elegant ontology, and solve the two problems in a single blow. (pp. 304–305)

Sayre (1976) similarly argues that "the concept of information provides a primitive for the analysis of both the physical and the mental." The notion that information somehow serves as the interface between the subjective and the objective is also a central component of Tononi's (2008) recent suggestion that consciousness arises when matter produces "integrated information," which is defined as "the amount of information generated by a complex of elements, above and beyond the information generated by its parts" (p. 216). The basic idea is that complex systems that integrate information, even potentially non-nonbiological ones, will experience some minimal amount of consciousness: something it is like to be that system (see also Koch 2012, 2013).

In sum, although there is considerable variability in the manner in which scholars have conceptualized the common ground of reality from which both the objective and subjective emerge, two common elements are 1) that the

interface occurs within the ongoing march of the present, and 2) that it is constituted within the shared informational properties entailed in both objective and subjective states. A final shared aspect of many of these approaches is that subjectivity represents a fundamental attribute of the universe that either permeates all aspects of matter (panpsychism), or exists as a potentiality of matter that emerges when certain conditions are met (protopanpsychism; Chalmers 2002). Drawing on these general observations, I turn now to offering my own highly speculative conjectures regarding a meta-perspective on reality that may provide the shared foundation for first- and third-person perspectives.

4.5 The possibility of a subjective dimension of reality

Many scholars who posit that subjectivity is an essential aspect of reality argue that ultimately physics may need to be expanded to include constructs corresponding to subjective states. As the philosopher David Chalmers (1995) observed:

> I propose that conscious experience be considered a fundamental feature, irreducible to anything more basic. … In the 19th century it turned out that electromagnetic phenomena could not be explained in terms of previously known principles. As a consequence, scientists introduced electromagnetic charge as a new fundamental entity and studied the associated fundamental laws. Similar reasoning should be applied to consciousness. If existing fundamental theories cannot encompass it, then something new is required. (p. 96)

Eminent physicist Andrei Linde (1990) has also speculated that consciousness may some day be recognized as part of our understanding of physics:

> Could it be that consciousness is an equally important part of the consistent picture of our world, despite the fact that so far one could safely ignore it in the description of the well-studied physical processes? Will it not turn out, with the further development of science, that the study of the universe and the study of consciousness are inseparably linked, and that ultimate progress in the one will be impossible without progress in the other? (p. 27)

The critical question, of course, is: What in the physical universe might correspond to the arising of consciousness?

To recap, the physical realm as currently construed offers no place for subjective experience, the flow of time, or the uniqueness of the present. In order to bridge the gap between physical reality and subjectivity, scholars have posited the existence of a neutral realm that gives rise to both. Though varied in their emphasis, two elements have emerged as likely components of this neutral ground: the evolving present and information. Together these considerations suggest that a conjoined first-person/third-person meta-perspective will likely conceptualize subjectivity, the present, and the flow of time within an architecture that closely links information to an ever-changing now. Toward this end I offer the following conjecture: *consciousness arises via the changing informational states associated with an observer's movement through objective time relative to a currently unacknowledged dimension or dimensions of subjective time.*

Although speculative and highly underspecified, the above account has intuitive appeal. The sense of moving through time from one informational state to the next is clearly central to experience. Indeed it could well be said that it is the defining aspect of our existence. It is difficult to conceive of experience without invoking movement in time and change in informational state. Recall however that the current block universe portrayal of time provides no way to conceptualize moving through time, as movement in time would require change in time at a rate that could never be specified. As the Physicist Paul Davies observes:

> But what meaning can be attached to the movement of time itself? Relative to what does it move? Whereas other types of motion relate one physical process to another, the

> putative flow of time relates time to itself. Posing the simple question 'How fast does time pass?' exposes the absurdity of the very idea. The trivial answer 'One second per second' tells us nothing at all. (2002, p. 8)

Thus to move in time requires movement in relationship to some dimension other than time itself. The postulation of an additional temporal dimension allows observers to change information states in objective time relative to subjective time. Indeed, it seems possible (and perhaps even a mathematical necessity) that in order to extend in and move through space-time (i.e., the block universe), there needs to be at least one additional dimension to provide the degree of freedom necessary to enable such movement (Schooler et al. 2011). In other words, if we accept the block universe model[5] of reality, then in order to move through objective time, we have to move relative to something, and that something cannot itself be time because all time exists simultaneously in the block universe. A seemingly reasonable solution is to posit an additional dimension (or dimensions) of time. Although the postulation of additional dimensions of reality should not be taken lightly, it is not without precedent. In physics, string theory has postulated seven additional spatial dimensions beyond the three dimensions of space and one dimension of time that are customarily acknowledged (Greene 2004). If there can be multiple dimensions of space, then might there not also be additional dimensions of time? Indeed, some physicists have argued that an additional dimension of time might be very useful for conceptualizing various issues in physics (Bars et al. 1998). If the postulation of an additional dimension (or dimensions) of subjective time could also resolve the paradox of time and provide a realm for subjectivity, then surely that would also warrant its consideration as a possibility.

I am not the first to suggest that the failure of objective time (as it is currently conceptualized) to afford the flow of time or inner experience may require the postulation of an additional subjective dimension (or dimensions) in which the observer moves relative to physical space-time (e.g., Smythies 2003). Noting the inability of current theories of physics to account for the flow of time or the existence of subjective experience, physicist Linde speculates that dimensions of consciousness may be required to provide the necessary degrees of freedom. Linde (2004) observes:

> Is it possible that consciousness, like space-time, has its own intrinsic degrees of freedom, and that neglecting these will lead to a description of the universe that is fundamentally incomplete? What if our perceptions are as real (or maybe, in a certain sense, are even more real) than material objects? What if my red, my blue, my pain, are really existing objects, not merely reflections of the really existing material world? Is it possible to introduce a 'space of elements of consciousness'....? (p. 451)

I remain agnostic regarding precisely how many additional dimensions may be required in order to provide the degrees of freedom necessary for time to flow and consciousness to have extensions in the present. Indeed, I am not even committed to the notion that such a realm must necessarily be thought of as possessing all of the mathematical formalities of spatial dimensions. My point is simply that the current material reductionist model of reality has left no room for time to flow or now to exist. It is as if physics has built a pendulum clock but left no space for the pendulum to swing. In statistics, there always must be one more degree of freedom than the total number of subjects and conditions so as to leave the freedom for variables to vary. I believe that such degrees of freedom are similarly required to enable experience to flow through time.

A dynamic depiction of the value of adding a second temporal dimension is illustrated in the following three examples depicting a simple event of bottles breaking. The first (Figure 13; see video clip in its description) depicts the event as it would unfold from the first-person perspective, a dramatic shattering of initially intact colored bottles. The second example (Figure 14) transforms this event into a

5 Another possible way of reconciling the challenges of the flow of time and the present is to discard the notion of the block universe. While this vantage is the prevailing view in physics (Greene 2004), some have suggested that it needs revising (Hunt 2014; Smolin 2013).

block universe depiction in which objective time is spatialized, and each slice corresponds to a separate moment of the event. Notice that in the block universe representation there is no motion (and hence no video clip), and no singular frame (i.e., slice) corresponds to "now." However, in the third example (Figure 15; see video clip in its description), an additional temporal dimension is introduced so that the observer can move through the block universe. Frame by frame a moving "now" marches through the block universe. By adding a second temporal dimension to the block universe, the dynamical experience of events unfolding is once again achieved.

A spatialized depiction of the notion of observers moving through subjective time relative to physical space and objective time is presented in Figures 16–18. As previously, noted, in the standard presentation of the block universe the three dimensions of space are, for graphical depiction, reduced down two dimensions (Figure 16). Here, in order to provide room to depict an additional dimension, physical space is further reduced to one dimension (Figure 17). Within this characterization, it is possible to see how the introduction of an additional dimension of subjective time (Figure 18) provides the necessary degree of freedom to enable an observer to move through time, as they can now move through physical time via a succession of moments in subjective time.

Figure 13: An event of breaking vases as it would be experienced from a first-person perspective. See http://open-mind.net/videomaterials/schooler_bootle_loaf5.mp4/view.

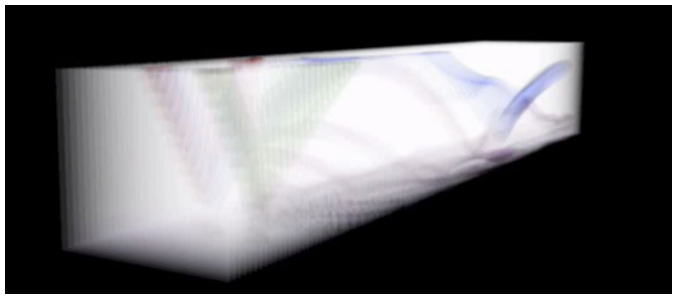

Figure 14: The breaking vases event is depicted as a block universe, with the temporal dimension spatialized, and each moment corresponding to a separate "slice." Notice that there is no way to depict "now" and no way to move through it.

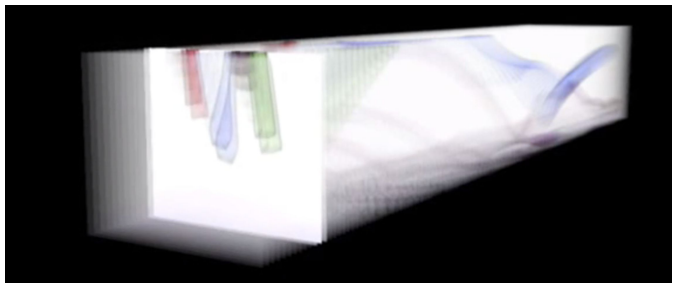

Figure 15: The breaking vases event is again depicted as a block universe, with the addition of a second temporal dimension. The moving present is represented as successive illuminated slices that progress from moment to moment through the block universe. Notice that witnessing movement through the block universe requires an additional dimension of time as the standard dimension of objective time is already dedicated to spatializing the block universe. See http://open-mind.net/videomaterials/schooler-bottles-loaf-1.mp4/view.

An interesting implication of this characterization is that observers can vary in the granularity (i.e., extent) of their moments. Notice how in Figure 17, the observer with the smaller spatial extent also occupies smaller successive moments in time.[6] Intriguingly, there is evidence to support this view: recent findings suggest that smaller vertebrates may have a different "temporal grain size" relative to larger verteb-

6 Although subjective agents may move in subjective time relative to objective time in varying sized steps, it does not appear that there is necessarily a single temporal grain size for the processing of all sensory stimuli. Specifically, Pöppel (1997) finds that the duration of what constitutes a single moment (as assessed by temporal discrimination of successive sensory events) varies between sensory modalities. This observation seems potentially consistent with the suggestion that even within a single individual there may be multiple distinct conscious systems (Schooler et al. 2011; Zeki 2003) corresponding to different sensory levels and systems.

rates. Specifically, Healy et al. (2013) report a negative correlation between vertebrate size and the highest rate at which they can detect the flickering of a light (the flicker fusion rate). From the vantage of the current discussion, these findings suggest that the consciousness of smaller animals may move through subjective time relative to physical time at a faster rate than larger animals. This may be why it is so hard to swat a fly: from its vantage, we are moving in slow motion.

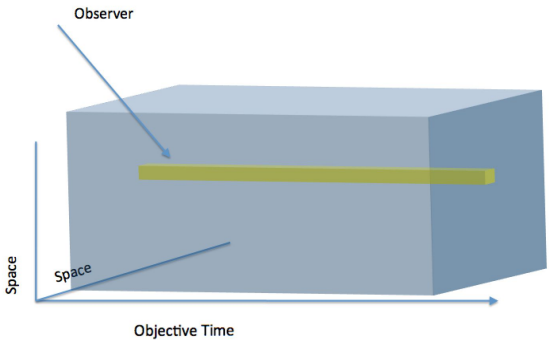

Figure 16: The observer depicted in the standard block universe with two dimensions of space. In the standard block universe, the observer is static and exists simultaneously in all locations. There is an insufficient number of degrees of freedom for the existence of a genuine now or movement in time.

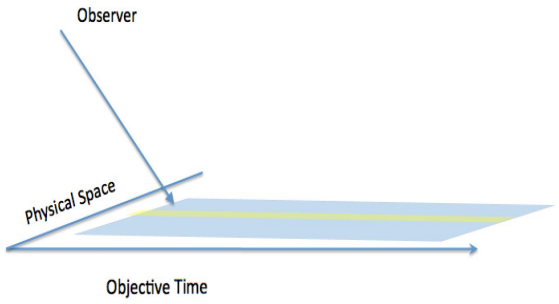

Figure 17: The observer depicted in a standard block universe with one dimension of space. As with the standard convention of depicting the block universe in two spatial dimensions instead of three, the reduction to one spatial dimension is useful for illustrative purposes.

A critical question that arises in postulating an additional subjective dimension (or dimensions) of time is: what are the properties of this dimension? I have left the answer to this question intentionally vague as I believe underspecification leaves greater room to flesh out the rudimentary idea in various possible ways. With that said, it seems plausible that the subjective temporal dimension(s) could correspond to subjective informational states in the same way that objective informational states correspond to different moments of objective time. As noted, subjective informational states are aligned with but not identical to objective informational states (recall Mary, the color scientist). Moreover, current theories of neutral monism posit information as being one of the core potential interfaces between the objective and the subjective. Thus, characterizing subjective time as corresponding to distinct subjective informational states that are aligned with but not identical to objective informational states seems a promising characterization of the nexus between the objective and the subjective.

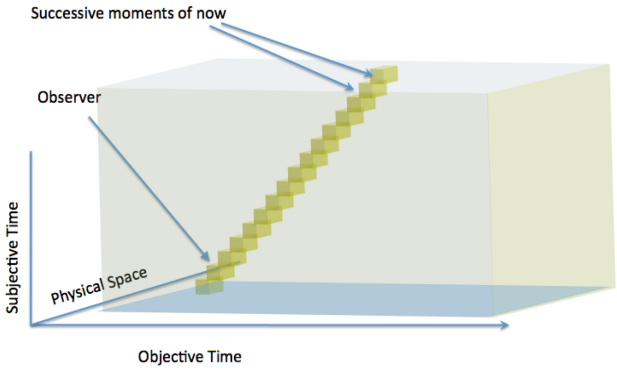

Figure 18: The observer depicted moving through a dynamic block universe with one dimension of physical space and the introduction of an additional subjective temporal dimension. In this model, there are a sufficient number of degrees of freedom to enable the observer to move in objective time relative to subjective time. The present can also be depicted as a series of moments extending in subjective time, objective time, and physical space.

A further potential benefit of the conjecture that experience emerges from movement in a subjective temporal dimension relative to objective time is that it provides a potential way of conceptualizing the nature of experience in the universe. Many scholars throughout history, and particularly those sympathetic to neutral monism, have articulated some type of panpsychic vision of nature, where all elements of

matter are seen as partaking in some rudimentary experience or proto-experience. Advocates of some version of panpsychism include Spinoza (1677/1985), Leibniz (1989), James (1909), Bergson (1896/1912), and Whitehead (1929). More recent adopters of this view include Hameroff & Powell (2009), Chalmers (1995), Hunt (2011, 2014), Koch 2013, Schooler et al. (2011), Skrbina (2005), and Strawson (2008). The notion that the flow of time emerges by virtue of movement in a subjective temporal dimension relative to an objective one provides a potential way of conceptualizing how all of matter may partake in experience at varying levels of complexity. Accordingly, if experience emerges by movement through a dimension of subjective time relative to objective time, then it seems quite plausible that elements associated with all of matter may be on a shared trajectory through these two (or more) temporal dimensions, and thus may be enjoying some form of experience. In other words, if consciousness emerges from something as potentially ubiquitous as movement through an additional time dimension, then it seems plausible that all matter could enjoy some modicum of experience.

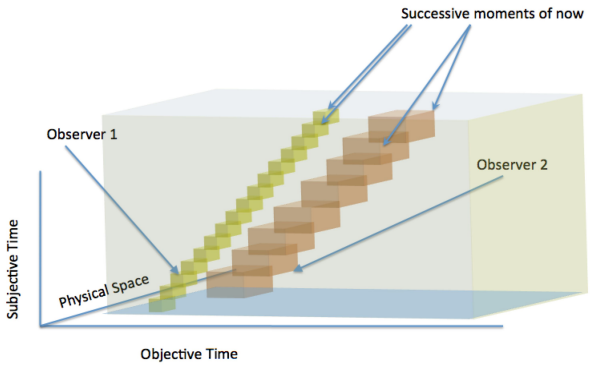

Figure 19: Two observers depicted moving through a dynamic block universe. Notice how this account enables varying temporal grain sizes between observers.

Although the present view provides a way of conceptualizing how matter might partake in at least some rudimentary form of experience, it need not suggest that all objects—collections of matter—are themselves sentient beings. To use Nagel's (1974) terminology, there need be nothing "that it is like to be" a rock, for example. Rather, the claim is that at some level, the constituent elements of a rock (and all other material objects) partake in at least some very rudimentary kind of experience, what the physicist/philosopher Alfred North Whitehead (1929) referred to as "actual entities". In other words, according to the panpsychic tradition, matter is constituted of collections of individual elements each of which partake in some minimal experience. The subjective state of these individual experiential elements (or "actual entities") is presumed to be extremely simple, and for the most part, when they combine, it is assumed that they form "mere aggregates" that do not entail a higher-order experience. However, under some circumstances, and in particular when present in certain organic structures, these simple actual entities may combine to form higher-order actual entities corresponding to the conscious agents that we typically acknowledge as such.

The notion of observers moving through objective time relative to a subjective temporal dimension may offer a possible direction toward solving the perennial "combination problem" of panpsychism, namely discerning how rudimentary proto-experiences of individual elements can combine to form the larger higher -order experiences that we enjoy (Hunt 2011). Accordingly, it seems possible that experience may correspond to oscillations in objective time relative to subjective time. As depicted in Figures 18 and 19, I have speculated that observers may move in subjective time relative to objective time in discrete steps. The precise timing of these steps from one moment to the next could potentially provide the foundation for a unified experience among elements (i.e., an approach to the combination problem). When elements oscillate in synchrony (i.e., when they all jump from one moment in subjective time to the next), this may produce a unity of conscious experience. Nervous systems may provide an organizational structure that enables material elements to oscillate in synchrony and thereby produce larger, more organized fields of subjective experience. In this sense, the combination problem may be addressed by, and our holistic experience may result from, the common wavelength of oscilla-

tion through objective time relative to subjective time that constituent elements of a singular experience partake in. Put colloquially, each of us may have our own unique wavelength moving through subjective time relative to objective time.

Importantly, these speculations are presented as an example of the kind of meta-perspective that might enable an acknowledgement of the reality of both first- and third-person vantages. This is far from a formal model, and leaves much unspecified. For example, although I believe it could be possible to formalize the relationship between subjective time and informational states, this remains a major conjecture. Other elements of the framework, such as the notion that observers move in discrete steps in subjective and objective time, and that the pattern of oscillation may provide a way of addressing the "combination problem," also are merely conjectures. I suspect that there are potentially a great variety of ways of conceptualizing how observers might move in a dimension of subjective time relative to objective time. My goal in attempting a rudimentary depiction of this notion is simply to fuel the conversation.[7]

Even if scientists resist the suggestion of an additional temporal dimension of reality, characterizing how experience can reside in a physical world will require explicating how observers move in physical time relative to changes in subjectively apprehended information. In other words, to be an observer in reality is arguably to reside in a now that corresponds to a "location" within continually changing information states. Thus, conceptualizing the experience of the observer requires understanding how that observer moves between informational states over time. Given that the present prevailing view of physics does not afford the degrees of freedom to actually move in time, understanding how an observer changes informational states relative to time seems to require at a minimum the postulation of a virtual dimension of subjective time. Whether that dimension is given ontological status as a genuine aspect of reality depends on one's perspective, but that of course is precisely the point.

For those who are willing to entertain the possibility of the kind of meta-perspective that I am envisioning, there are a number of possible ways forward. Perhaps, and most dramatically, it seems plausible that the existence of an additional temporal dimension may have empirical consequences. Although received with understandable skepticism, evidence continues to accumulate for precognition (i.e., that the mind is sensitive to events that have not yet occurred). There is a long tradition of research in this area (Honorton & Ferrari 1989). For example, Bem (2011) recently published a series of nine studies in a highly respected journal that seem to suggest evidence of genuine precognition and a subsequent meta-analysis of 90 additional findings appear to further substantiate these findings (Bem et al. 2014). Not surprisingly, these claims have been met with considerable skepticism (e.g., Ritchie et al. 2012; Wagenmakers et al. 2011). Given their profound challenge to our current scientific understanding of reality, claims of this sort will require studies that offer highly tangible evidence that cannot be attributed to artifact or statistical anomaly, e.g., taking advantage of people's alleged precognitive capacities to make consistent future predictions of real world events, such as the future outcome of roulette wheel spins or the stock market (Franklin et al. in press). Nevertheless, the demonstration of robust findings of precognition might provide the type of data that could inform theories of how consciousness interfaces with time in a manner not currently considered in modern science.

7 Several years ago, I presented the idea that consciousness entails movement through a subjective dimension of time using the depiction in Figure 15 and illustrated at the site: http://open-mind.net/videomaterials/schooler-bottles-loaf-1.mp4/view. One of the attendees, Robert Forman (see his description of the event, Forman 2008), suggested that although he was intrigued by my depiction, that it did not square with his intuitions. In my model, the block universe is fixed and consciousness marches through it. He suggested that his intuition was the opposite: namely that the field of the observer remains fixed and time passes by, or changes within it. This alternative vantage in which time evolves through a fixed observer seems a worthy alternative perspective for conceptualizing the ever -changing now that may be closer to approximating several other neutral monist vantages (e.g., Whitehead 1929, and Hunt 2014). While I think this alternative viewpoint is worthy of consideration, I also think it is likely that the two vantages are logically equivalent—it is simply a question of which one is taken as the fixed frame of reference. Nevertheless the manner in which we construe the movement of time relative to the individual may have important psychological consequences (Casasanto & Boroditsky 2008).

Other approaches for fleshing out the kind of meta-perspective suggested here may include quantitative reconceptualization of existing findings. Although quantum theory is one of the most precisely predictive theories ever conceived, its explanation remains a mystery. In particular, the manner in which measurement seems to affect outcomes, and the theoretical relationship between measurement, consciousness, and the collapse of the wave function are not at all understood (Chalmers 2002). It seems possible that the postulation of an additional subjective dimension of time might lead to alternative ways of conceptualizing current formalism.[8] Indeed it seems possible that once psychological constructs (such as a dimension of subjective time) are integrated with physical principles, that new psycho/physical laws of nature may emerge (Chalmers 2002; J. N. Schooler 2010). Alternatively, the notion that subjective experience emerges from movement through another dimension of time may resist empirical documentation, but may nevertheless remain a conjecture that appeals to some intuitions but not others.

Even if ultimately there is no conclusive ways of determining whether there exists an additional subjective dimension of time this does not mean that the consideration or rejection of this view should be arbitrary. There are many judgments in life that rely on leanings that are not purely objective in nature. From ethics to art we routinely favor some views over others for reasons besides purely objective facts. Indeed the adoption or rejection of views close to those under discussion here are often based on subjective considerations. For example some physicists embrace string theory because of the elegance of its mathematics, whereas others reject it because there is no physical evidence to support it. Similarly there is great debate on how far down the phylogenetic scale we should postulate the existence of consciousness. Most of us have an opinion on this matter, but it remains entirely unclear whether there will ever be a purely objective way to resolve it. In the absence of objective evidence, our positions on these issues are far from arbitrary, rather they are based on the same sorts of sensibilities and intuitions that underpin many of our most heartfelt convictions.

In a final further effort to appeal to readers' intuitions, let me introduce one last metaphor for the meta-perspective I am striving for: consider the allegorical tale of *Flatland*, written by Edwin Abbott (1885) more than a century ago. Flatland depicts a two-dimensional world that is visited by a three-dimensional being (a sphere). The sphere takes a citizen of Flatland (a square) on a journey through the third dimension, offering the square a vantage on his reality that he never had before. The story of Flatland offers a number of useful lessons for the present discussion. First, it provides a powerful metaphor for thinking about the existence of additional dimensions of reality. Long preceding relativity theory, which treats time like a fourth dimension, or string theory, which currently posits the existence of up to seven additional spatial dimensions (Greene 2004), Abbott's tale introduces us to the concept of higher-order dimensions. Flatland describes how additional dimensions can be both embedded in and yet simultaneously transcend what we know. The parallels to consciousness are also striking: when the square is taken through the

8 Although not a mathematician it seems plausible to me that existing mathematical formalisms might be adopted to accommodate some of the present conjectures. Most speculatively, a quantitative characterization of additional dimensions of time might correspond in some manner to the many worlds account of quantum mechanics (Everett 1957) that postulates that every potential alternative outcome of quantum events entails a different branching parallel universe. It strikes me as possible that these so called "many worlds" could correspond to different coordinates in additional temporal dimensions. From this vantage, the block universe might be better conceived of as a block multiverse, with innumerable distinct temporal projections. Several multi-dimensional theories of objective time might (e.g., Bars et al. 1998; Craig & Weinstein 2008) also be relevant. Also potentially pertinent are various existing quantitative efforts to reconcile experience and physical matter. For example, the magnitude of a conscious observer's extension in subjective time might correspond to Tononi's (2008) quantitative assessment of Φ (pronounced "fi") which he characterizes as corresponding to the amount of integrated information that a conscious observer apprehends at any particular moment. Other potentially relevant formal approaches for reconciling consciousness with physical matter include: Hameroff & Penrose's (2014) efforts to explain how consciousness may "consists of a sequence of discrete events, each being a moment of 'objective reduction' (OR) of a quantum state" (p. 73), and Tegmark's (2014) suggestion that "consciousness can be understood as a state of matter, 'perceptronium', with distinctive information processing abilities" (p. 1). The relevance of these various approaches is highly speculative, and indeed given their disparities it is unlikely that they could be mutually accommodated. My point in mentioning them is simply to point the way towards some more formal approaches that might hold potential for advancing this discussion.

third dimension, he suddenly sees inside the objects of Flatland. Like consciousness, movement in an additional dimension in Flatland enables the perception of an inside where none could otherwise be possible. Like consciousness's relationship to reality, an additional dimension intersects with the lower dimensions and yet is distinct from them. And like the recognition of an additional dimension in Flatland, positing consciousness as moving through objective time relative to a dimension (or dimensions) of subjective time provides an example of a meta-perspective that potentially offers observers a new way of conceptualizing their relationship with physical reality. Although I make no claims as to having fleshed out this meta-perspective, it is my hope that my arguments have persuaded at least some readers that it is a vantage worth considering.

5 Summary and final conclusions

In this paper I used the thesis that perspective shifting can fundamentally alter how we conceive and evaluate evidence as the backdrop for exploring one of the most perennial and challenging of all perspectives shifts: namely, between the subjective first-person perspective that provides each of us with a unique window onto reality, and the objective third-person perspective that serves as the consensual foundation for science. My arguments were divided into three sections, which though admittedly distinct in their focus, all converge in attempting to elucidate a rapprochement between the subjective and objective perspectives on human experience.

In the first section I introduced the notion of perspective shifting in the context of classic reversible images. Here I argued that reversible images provide a context for conceptualizing how the very same situation can be understood from two very different perspectives that appear to produce seemingly irreconcilable accounts of their contents. However, once this juxtaposition is recognized, a meta-perspective emerges that enables the appreciation of both perspectives even if they cannot be apprehended simultaneously. The perspective shifting and meta-perspective that arise from reversible images provide a metaphor for conceptualizing the tension between the first- and third-person perspective for understanding human experience. Both researcher and the field of science itself have been divided on whether to take perspectives on human nature that emphasize inner experience or external behaviors. While historically this has been a debate on which researchers have been forced to take sides, I argue that we should strive towards a meta-perspective in which the two vantages can inform one another.

In the second section I sought to show how the third-person perspective of objective science can elucidate our understanding of first-person experience. Towards this end, I introduced the distinction between having an experience (experiential consciousness) and one's explicit understanding of that experience (meta-awareness). Historically when researchers have sought to understand people's actual experience they have relied on people's self-reports about what they believe they were experiencing. This has led some to argue that it is impossible to gain insight into underlying experience. However, I argue that through triangulation between self-reports and behavioral and physiological measures, it is possible to make reasoned inferences about people's actual experience; identifying both situations in which meta-awareness overlooks experience (temporal dissociations of meta-awareness) and cases in which it distorts them (translations dissociations of meta-awareness). This framework was fleshed out within an extensive review of research on mind-wandering that, because of its inherently private nature, provides an ideal testing ground for developing a third-person science of first-person experience. By assessing the relationship between people's behavioral and physiological measures and self-report this review concludes that while people's self-reports of mind-wandering routinely correspond to genuinely experienced instances of this mental state, they nevertheless often fail to notice mind-wandering while it is occurring.

In the final and most speculative section of this paper, I turned the tables around. Instead of asking how third-person science clarifies first-person experience, I asked how first-person experience may inform third-person science. Here I ar-

gued that there are certain aspects of first-person experience that are so fundamental that they may reasonably serve as axioms of existence that any construal of physical reality must be able to accommodate. As detailed in the prior section it is clear that many aspects of experience may be illusory but several can reasonably be construed as unassailable, including: the occurrence of experience, the flow of time and the privileged present. Notably, current accounts of physical reality offer no way of accommodating these inherent aspects of first-person experience. This conflict between seemingly self-evident aspects of personal experience and current accounts of physical reality leads me to posit that, like the reversible images that can only be accommodated by recognizing a larger meta-perspective in which they both reside, so too there must exist some meta-perspective that can accommodate both objective scientific facts and personally experienced ones. Towards this end I introduced a highly speculative conjecture about the larger framework in which both objective and subjective perspectives might reside. Namely that consciousness involves a fundamental aspect of the universe that arises via the changing informational states associated with an observer's movement through objective time relative to a currently unacknowledged dimension or dimensions of subjective time. Although highly speculative, I offer this account as an example of the kind of meta-perspective that may simultaneously accommodate extant objective observations and certain aspects of subjective experience that I find as compelling as the existence of physical reality itself.

In my view, bridging the objective/subjective divide will require adopting a meta-perspective in which the two points of view are viewed as alternative vantages on an underpinning reality that corresponds to both but can be fully accommodated by neither alone. As I attempted to illustrate at the outset, it is quite possible to hold inaccurate or incomplete beliefs about one's experience, and third-person science can help to illuminate such errors. However, from my vantage there are certain elements of subjective experience that are as axiomatic as any aspect of the physical realm. Nevertheless, I recognize that not all will see it this way. Some will remain exclusively fixed to the third-person perspective of objective science, while others will conceive of reality exclusively from their own personal first-person point of view. In conceptualizing this breadth of perspectives, it is important to remain mindful of an essential insight of Bayes' theorem of probability. Bayes' theorem states that in calculating the probability of something one must integrate new evidence with one's *a priori* probabilities. From a Baysian perspective, for those who believe that something is impossible (i.e., infinitely unlikely) there is no amount of evidence or argument that should sway them. The ontological reality of first-person experience seems very much to fit in this category. My arguments on this point will likely remain wholly unpersuasive to those who cannot conceive of subjective experience as offering an epistemological authority that rivals science. However, for those open to the possibility that science will need to find a way to accommodate the reality of both the subjective and objective perspectives, I hope my discussion offers some glimmers as to what such a meta-perspective might be like.

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