How do you measure something so elusive as a dream? This is a central challenge for dream researchers, one that has inspired scientific discoveries and philosophical skepticism. Jennifer Windt’s answer to the challenge is old-fashioned, yet plausible. Scientists do not need fancy instruments to measure dreaming, such as brain scanners that “read” your dreams (Windt 2015, §3.7). Rather, scientists can—indeed, they must—measure dreams with introspective “dream reports”, which have been in use since the inception of dream research. Windt argues for the methodological necessity of dream reports over the first four chapters of her wonderful book *Dreaming* (Windt 2015, Chapters 1 through 4). Like all Windt’s arguments, this one is careful, persuasive, and steeped in scientific detail (§1).

Yet I left *Dreaming* without a sense of why introspective reports play a special role in dream research, as compared to other areas of psychology. What makes dreams so elusive? Why must we use report to capture them? These are the central questions of my paper. I consider and reject an obvious answer: dream reports are methodologically necessary because dreams are conscious experiences (§2). I provide an alternative, action theoretic, explanation for the special role of dream reports. Because the onset of dreaming is not under voluntary control, subjects cannot perform voluntary experimental tasks that initiate dreaming. In lieu of experimental tasks, dream researchers rely on self-report (§3.2). Dream reporting is part of a broader methodological movement that I call “task-free psychology”, whose practitioners use self-report to study passive processes like dreaming and mind-wandering (§3.2). Although task-free psychology holds promise, I argue that it faces a unique problem of causal inference: without tasks, it’s unclear how psychologists can perform the interventions necessary to determine the effects of dreaming or mind-wandering (§3.3). Drawing on action theory and interventionist theories of causation, we can better understand the motivations and limits of task-free psychology, as well as ways that the field can progress.

1 The Methodological Necessity of Dream Reports

Windt (2015, Chapter 1–3) argues that dream reports are methodologically necessary for dream research. That is,

\[(\text{Methodological Necessity}) = \text{To measure the presence, absence, or phenomenal character of dreaming, dream researchers can, and necessarily must, use either (1) dream reports or (2) methods that are ultimately justified by dream reports.}\]

Before we explicate Windt’s argument for Methodological Necessity, we must first get her definition of dream reports on the table:
**Dream Report** = (def.) “The product of (verbal or nonverbal) behaviours conducted with the sincere intent of conveying or recording certain relevant information about a specific dream” (Windt 2015, p. 196)

Dream reports can be offered after a participant is woken by an experimenter in a sleep laboratory, or after a participant wakes spontaneously at home. Typically, participants who report that they were dreaming give further details about their dreams, either through free reports or by answering questions.

Let’s consider an actual dream report to make Windt’s definition more concrete:

Last night I had a dream that I was swimming in the river in Van Gogh’s Starry Night Over the Rhone. It was cold and windy, but the water was warm. There were islands that were actually paintings, and sometimes I wanted a break, so I would grab onto the paintings, but then the oil would run and the canvas was ruined (Schneider and Domhoff 1999)

Windt would classify this description as a dream report, since it is a sincere attempt to convey information about a specific dream.

Windt holds that these kind of dream reports are methodologically necessary for dream research. Windt’s argument for Methodological Necessity rests on a broad and vibrant discussion of the history of dream research (2015, Chapters 2–3). Specifically, Windt surveys how dream researchers rely on self-report, even when they purport to use less subjective methods. Consider the researchers who discovered the most important behavioural marker of dreaming: Rapid Eye Movement (REM) (Aserinsky and Kleitman 1953; cf. Windt 2015, § 2.1, 3.1). Relative to non-REM (NREM) sleep, REM sleep is associated with heightened, wake-like, brain activity, rapid eye movements, and frequent reports of dreaming. Early dream researchers hoped that the discovery of REM sleep would make dream reports superfluous:

An objective measurement of dreaming may be accomplished by recording REMs during sleep. This stands in marked contrast to the forgetting, distortion, and other factors that are involved in the reliance on the subjective recall of dreams (Dement and Kleitman 1957, p. 346).

Windt argues that measures of REM sleep cannot supplant dream reports for two reasons. Her first reason is empirical: REM sleep and dreaming are doubly dissociable, so we cannot use the former to measure the latter (Windt 2015, p. 82). Subjects report that they were dreaming after 82% of REM awakenings, and 43% of NREM awakenings (Nielsen 2000, p. 855) and these percentages vary between studies (Windt 2015, p. 82). So REM sleep is neither empirically necessary nor sufficient for dreaming. As a matter of contingent empirical fact, therefore, scientists cannot use the behavioural or neural markers of REM sleep alone to measure dreaming.

Windt’s second argument is theoretical: dream reports were necessary to determine whether dreaming and REM sleep are dissociable (Windt 2015, p. 82). Importantly, this response does not hinge on any contingent empirical findings within dream science. Consider a thought experiment, where dream researchers found a perfect correlation between
REM sleep and dream reports. REM sleep would subsequently be sufficient to measure dreaming. Yet even in this thought experiment, dream reports would have been necessary to justify the claim that dreaming and REM sleep are perfectly correlated. Thus, the justification for studies that use REM sleep to measure dreaming would still bottom out in report. In this sense, dream reports would still be methodologically necessary for dream research in our hypothetical world.

Crucially, Windt’s second argument will generalize to any future measure of dreaming. Consider dream-reading techniques, where researchers predict whether one is dreaming based on one’s brain activity (Windt 2015, § 3.7). Suppose dream-reading improves to the point where these techniques perfectly predict dream reports. Citing these predictions, dream researchers could then use dream-reading alone to measure dreaming. Yet the epistemic justification for dream-reading techniques would still bottom out in report: scientists would develop, calibrate, and justify dream-reading techniques by testing how well they predict dream reports. So according to Windt, dream reports would still be methodologically necessary, even in this (currently) science fiction scenario.

2 Dream Reports and Consciousness

Windt convincingly documents the special role of report in dream science. Yet I left Dreaming with a nagging question: why does self-report play a special role in dream research, compared to other areas of psychology? What feature of dreaming explains the importance of dream reports? These are the central questions of my paper.

My answer appeals to action theory: because dreams are passive, we cannot study them using voluntary experimental tasks. The alternative is to use self-report (§ 3). However, I must address a competing answer before I develop my own. One might argue that dream reports are methodologically necessary because dreams are conscious experiences. Prima facie, this “Consciousness Explanation” seems promising: after all, self-report is arguably crucial for the science of consciousness (Chalmers 1999; Varela 1996). However, the Consciousness Explanation is limited in two ways.

First, Windt cannot endorse the Consciousness Explanation on pain of circularity. Windt appeals to the necessity of dream reports to support one of her core claims: as a matter of methodological necessity, dream researchers must assume that dreams are conscious experiences (Windt 2015, p. 5). Windt’s argument would be viciously circular, if she were to also accept the Consciousness Explanation. Here’s how the circular argument would go: dream researchers must assume that dreams are conscious. Why? Because dream reports are methodologically necessary. Why? Because dreams are conscious. Something has to give; for Windt, I suspect that would be the Consciousness Explanation.

Second, the Consciousness Explanation rests on a problematic assumption: self-report plays the same role in the study of dreams and other forms of conscious experience. But self-report is more methodologically central to dream research than research on other conscious phenomena, such as imagination, perception, and memory. Consider the classic “mental rotation” paradigm in visual imagery research (see Thomas 2014 for a review). We’ll see that self-
Table 1: Sample stimuli from Shepard and Metzler (1971). The shape pairs in A and B are identical, though rotated. The shapes in C are mirror images.

report plays a relatively minor role in this paradigm, compared to dream research.

In the original mental rotation study, Shepard and Metzler (1971) presented subjects with drawings of 3D shapes (Fig 1). The task was to identify whether two shapes were identical, though rotated, or mirror images. Shepard and Metzler predicted that people would use conscious mental imagery to perform this task: they would form a picture of one shape in their mind, and mentally “rotate” this picture until it matches (or does not match) the second shape. Shepard and Metzler’s imagistic hypothesis contrasts with the theory that all thought occurs in language, a prevalent belief at the time.

Shepard and Metzler produced two lines of evidence for their mental rotation hypothesis. First, subjects’ reaction times were directly proportional to the angular rotation between two shapes. Subjects therefore seemed to “rotate” their mental images at a constant rate, until the two imagined shapes were presented at the same (or a similar) angle. Shepard and his students (especially Lynn Cooper) replicated this central result—that reaction time increased with mental rotation—in many subsequent studies (see Shepard and Cooper 1986 for a review). Here is the crucial point for our purposes: Shepard’s reaction time data provides evidence for the existence of conscious mental imagery that does not epistemically depend on self-report.
Admittedly, Shepard and Metzler appealed to self-report data for a second line of evidence. In a post-experiment questionnaire, subjects reported that they rotated an imagined figure to complete the task. However, self-report played a less epistemically foundational role here than in dream research. Shepard and Metzler presented self-report data only to introduce their hypothesis, noting that their reaction time data are “consistent…with an explanation suggested by the subjects themselves[,] although introspective reports must be interpreted with caution” (Shepard and Metzler 1971, p. 701). Other than this remark, Shepard and Metzler focused exclusively on their findings about reaction times. Likewise, psychologists who discuss and teach Shepard’s mental rotation studies typically emphasize their data about reaction times rather than self-reports. It is as almost as if self-report was used to discover, but not justify, Shepard’s hypothesis. This stands in marked contrast to the foundational role of dream reports, which are the standard by which researchers validate and test other measures of dreaming, such as REM sleep (Windt 2015, Chapters 2–3; §1).

Self-report plays a more foundational role in the methods of dream research than research on conscious mental imagery. A similar argument could be made for research on other forms of conscious experience such as perception and memory (although this argument is outside the bounds of my paper). Here’s what matters for us: the mere fact that dreams are conscious experiences cannot explain the special methodological role of dream reports.

What feature of dreaming explains the special status of dream reports? Shepard and Metzler’s study gives us a hint. They gave subjects a task: compare two three dimensional figures. Based on subjects’ task-performance, Shepard and Metzler inferred that subjects used a specific type of cognitive process—namely, mental imagery—to perform that task. Crucially, this study design presupposes that subjects can use mental imagery to voluntarily perform a task. Herein lies the difference with dream research: because dreams are passive, we cannot study them using voluntary experimental tasks. The alternative is to use self-report (§3). We’ll see that my action-theoretic account not only explains the special role of dream reports, but also sheds light on a broader movement that I’ll call “task-free psychology”.

2.1 Methodological Necessity or Something Weaker?

My goal is to explain the special methodological role of dream reports. So far, the motivation for my explanandum has been Windt’s claim that dream reports are methodologically necessary for dream research. But Methodological Necessity is a strong and potentially contentious thesis (albeit one with which I am deeply sympathetic). It’s therefore important that my positive proposal does not hang on whether we accept Methodological Necessity, or attribute a weaker (albeit still special) role to dream reports.

Methodological Necessity implies that there could be no dream research without dream reports. To see why this implication might be contentious, consider a thought experiment. Twin Earth is exactly like Earth, except for two features of how people dream. First, everyone on Twin Earth has immediate and total amnesia about their dreams when they wake up. Since no one remembers dreams, no one reports them upon awakening. Methodological Necessity
implies that there could be no Twin dream research, even in principle. Windt endorses a similar claim: “If experiences
during sleep exist that are principally unreportable—for instance, by being below the threshold even of short-term
memory—…then these experiences are not the object of scientific dream research.”

But Twin Earth is unique a second respect: dream enactment is pervasive. Dream enactment is a real phenomenon,
where people physically act out their dreams while asleep. Here is Windt’s description of one actual case:

One vivid example [of dream enactment] involved a man who held his wife’s head in a headlock while
moving his legs as if running while both were attempting to sleep in bed, then exclaimed, “I’m gonna make
that touchdown!” and then attempted to forcefully throw her head down toward the foot of the bed. When
awakened, he recalled a dream in which he was running for a touchdown, and he spiked the “football” in
the end zone. His wife knew precisely what he had been dreaming about (Windt 2015, p. 98; cf. Boeve
2010, p. 18).

In the actual world, dream enactment is rare. In contrast, Twin Earthlings act out all their dreams with the same vigour
as the man in the above example.

Given the evidence from dream enactment, Twin Earth scientists hypothesize that people have vivid experiences
while asleep. They call these experiences “dreams”. Although no Twin Earthling has ever reported a dream upon
awakening, scientists correctly predict that this is because people immediately forget their dreams. Twin Earth scien-
tists form and test many hypotheses about these forgotten dreams. They develop systematic ways to analyze dream
enactment (just as actual dream scientists analyze dream reports), and subsequently draw conclusions about the typ-
ical contents of dreams. Twin Earth neuroscientists discover that dream enactment (and by hypothesis dreaming) is
associated with different patterns of neural activity than placid sleep. These neuroscientists even find a tight corre-
lation between distinct dream behaviours (e.g. running vs talking) and brain activation. Twin Earthlings develop a
rich field around dream enactment, refining their methods and drawing many of the same conclusions as actual dream
researchers. Yet despite all this progress, no Twin Earthling has ever uttered a dream report.

Here is the crucial question: does anything on Twin Earth count as dream research? If yes, then dream reports are
not methodologically necessary for dream research (contra Windt). If no, then dream reports are truly indispensable. I
am honestly not sure what I think. Fortunately, the remainder of my paper does not hang on how we resolve this difficult
question. Perhaps there are possible worlds where we could have dream research without self-report. Regardless,
Windt has decisively shown that dream reports play a central, even foundational, role in actual dream research ($\S$ 1). Furthermore, the fact that dreams are conscious cannot explain the special status of dream reports ($\S$ 2). The question

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1In this passage, Windt goes on to make a much stronger claim: unreportable sleep experiences “do not count as dreams” (Windt 2015, 172,
my emphasis). Here, Windt endorses a verification criterion for what counts as a dream: if participants cannot report a dream experience (and thus,
scientists cannot observe it), that experience is not a dream. Note that Windt does not deny that these are experiences. She just claims that they
do not count as dreams. I’m skeptical of verificationism in general and this criterion in particular. But I will focus on the rest of Windt’s passage,
because it is more germane to my paper.
then remains: why are dream reports so important? I'll now turn to my answer, which concerns the passivity of dreaming.

3 Self-Report in Task-Free Psychology

Why are dream reports methodologically central to dream research? My answer is action-theoretic: dreams are passive in a way that frustrates the standard, task-based, methods of cognitive neuroscience. I'll argue that a similar problem confronts research on passive mind-wandering. Psychologists who study passive cognition have therefore embraced “task-free” methods, which use self-report to measure dreaming and mind-wandering.

3.1 Task-Based Psychology

Cognitive psychologists typically use experimental tasks to study mental states or processes. Experimental tasks have two defining features that are relevant for our purposes. First, tasks are actions that subjects can voluntarily perform (typically when asked by the experimenter). Second, the actions in question activate some particular psychological process or state that researchers want to study. Consider a toy example of an experimental task: subjects are presented with a sequence of words (‘carrot’, ‘rabbit’, ‘zucchini’, ‘tomato’, ‘seagull’…) and asked to quickly say whether each refers to an animal or vegetable. Why is this a task? First, subjects can voluntarily classify a word’s referent. Second, doing so activates a particular psychological process that researchers want to study—semantic processing—since subjects must think about the meaning of words.

When a subject performs an experimental task, she thereby activates psychological processes at the experimenter’s request. Likewise, experimenters can use tasks to study psychological processes in a controlled setting, often by contrasting experimental and control conditions. Subjects in the experimental condition perform a task $T_e$, which activates a psychological process $P$. Subjects in the control condition(s) perform one or more tasks $T_c$, which do not activate $P$ but are matched to $T_e$ otherwise. Observed differences between the two conditions—in brain activation, for example—can therefore be attributed to the presence or absence of the process $P$.

Let’s expand on our toy example to illustrate this strategy. In our example, the experimental task ($T_e$) is to make semantic judgments about a sequence of words (e.g. does ‘carrot’ refer to an animal or vegetable?). In contrast, the control task ($T_c$) is to make syntactic judgments about those same words (e.g. how many vowels are in ‘carrot’?). Now let’s say that psychologists observe differences between subjects in the experimental and control conditions. Perhaps subjects in the different conditions show different patterns of brain activity, or different levels of performance on a subsequent word recall test. Or perhaps performance in the two condition correlates differently with age, intelligence, or personality traits. Because $T_c$ and $T_e$ are otherwise matched, the differences between these conditions can be attributed to the differences between semantic versus syntactic processing. For example, the results of our toy experiment might
suggest that semantic, as compared to syntactic, processing is associated with more activation in pre-frontal regions, greater benefits for recall, or larger performance deficits with ageing.

Crucially, task-based methods also allow researchers to study psychological processes and states without self-report. To see why, think about our toy example. The experimental task *requires* semantic processing: one must think about the *meaning of a word* to say whether it refers to an animal or vegetable. We therefore have no need to ask subjects self-report questions such as, “did you think about the meaning of the word?” So long as subjects successfully complete the experimental task, we already know that the answer is “yes”. Without using self-report, therefore, we can use this method to investigate semantic processing. Despite the advantages of task-based methods, however, we’ll now see that they have a blind spot when it comes to dreams and mind-wandering.

### 3.2 Task-Free Psychology

Dreams are passive in a way that frustrates task-based methods in cognitive psychology. Recall that tasks are voluntary actions that activate the cognitive processes one wishes to study. Task-based dream research would therefore require a voluntary task\(^2\) that activates dreaming. But the passivity of dreams implies that there is no such task; one cannot voluntarily begin to dream. We must make this point carefully, because it is possible to regain agency within a dream. Specifically, lucid dreamers become aware of the fact that they are dreaming (Windt 2015, pp. 105–120). Sometimes, lucid dreamers also regain the capacity to control their actions within a dream (by deciding to fly, for example). Importantly, however, even lucid dreamers cannot voluntarily *begin to dream*.

We’ve isolated a crucial difference between dream research and task-based experimental psychology. Psychologists can assign voluntary tasks that initiate semantic processing (§ 3.1), for example, or visual imagery (§ 2). But there is no voluntary task that initiates dreaming. So how can one study dreams without a task? The dominant alternative is through dream reports. Although subjects cannot voluntarily begin to dream, they can voluntarily report their memories of dreaming upon awakening. We can use those reports to measure the presence, absence, and contents of dreams.

Dream researchers use self-report to overcome a limitation with task-based methods. In this sense, dream research is part of a broader movement that I call “task-free psychology”. Let’s first characterize task-free psychology in the abstract, and then in another field: mind-wandering research. In the abstract, the movement is designed to overcome a methodological limitation of task-based methods. Scientists can use these methods to study a cognitive process only if subjects can voluntarily perform a task that activates that process. But due to the limits of human agency, certain cognitive processes cannot be activated by voluntary human tasks. Task-based methods are therefore blind to an array of passive human experience. Fortunately, subjects can report on the presence, absence, or content of (at least some of) those experiences. Self-report is therefore a way to bring the passive side of our mental lives back into view.

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\(^2\)By using the term ‘voluntary task’, I do not mean to imply that people can perform tasks involuntarily (I’m neutral about whether involuntary task performance is possible). Rather, I simply wish to emphasize that participants in psychology experiments voluntarily perform tasks. I thank Aaron Glasser for pushing me to clarify this point.
Mind-wandering researchers have also embraced task-free methods. Task-based methods are unsuitable for mind-wandering research, in short, because one cannot mind-wander as a task. How one develops a longer answer depends on one’s definition of mind-wandering. Psychologists typically define mind-wandering as task-unrelated thought (Smallwood and Schooler 2015): that is, thought that is unrelated to any of the subjects’ current tasks. For example, suppose you are in a mental rotation experiment and you begin to think about what to cook for dinner tonight. Your thoughts count as mind-wandering, on the standard definition, because you are not thinking about the mental rotation task. Why can’t you assign the task of mind-wandering? Consider what this would involve. Suppose we tell someone in a mental rotation experiment to think about something else; to do so, he decides to think about what to make for dinner. But now, his thoughts about dinner are not task-unrelated! Rather, his thoughts are simply related to a new task: think about something other than mental rotation (see Irving 2016, p. 555 for a similar argument).

The foregoing argument rests on a conception of mind-wandering as task-unrelated thought. I need a new argument, because I’ve defended a different definition of mind-wandering as unguided thinking (Irving 2016; Irving and Thompson 2018; Christoff, Irving, Fox, Spreng, and Andrews-Hanna 2016; Mills, Raffaelli, Irving, Stan, and Christoff 2017; Andrews-Hanna, Irving, Fox, Spreng, and Christoff 2018). I characterize mind-wandering in terms of its dynamics: a wandering mind drifts aimlessly from one topic to another. In contrast, our thoughts remain on topic when we focus on a task (e.g. determining whether two 3D shapes are identical). My explanation for this dynamic difference appeals to guidance (Irving 2016). When someone performs a task (say, determine whether words refer to animals or vegetables), her attention is guided towards relevant information (the meaning of words) and away from irrelevant distractions (a buzzing fly or the number of letters in words). In contrast, a wandering mind is not guided towards anything in particular; instead, it is free to drift from topic to topic unchecked. Here’s why task-based methods are unsuitable to initiate unguided thought: when you tell someone to think about something other than mental rotation, for example, she will guide her thoughts towards other information such as what to make for dinner. But because her thoughts are guided, they are no longer free to wander from topic to topic unchecked.

In lieu of tasks, mind-wandering researchers use self-report methods called “thought sampling” (see Smallwood and Schooler 2015, pp. 490–491 and Smallwood and Schooler 2006 for reviews). Specifically, subjects answer questions about their thoughts while they perform a laboratory task or go about their daily lives. In the most common thought sampling method, subjects are periodically interrupted and respond to prompts such as, “at the time of the [interruption], my mind had wandered to something other than what I was doing” (Kane, Brown, McVay, Silvia, Myin-Germeys, and Kwapil 2007, p. 616). In this study, subjects who answer “yes” are classified as mind-wandering. Researchers

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3 It may be no accident that methods in dream and mind-wandering research are similar. Neuroscientists have argued that dreaming is a form of mind-wandering (Fox, Nijeboer, Solomonova, Domhoff, and Christoff 2013) or at least that the two belong to the same family of spontaneous thought (Christoff, Irving, Fox, Spreng, and Andrews-Hanna 2016; cf. Metzinger 2013).

4 In my empirical collaborations, I say that mind-wandering is “spontaneous” rather than “unguided”. I believe that there is a species–genera relationship between my philosophical and empirical theories. That is, one way to be spontaneous is to be unguided. My empirical collaborations are therefore less committed than my philosophical view.

5 This method is called “probe-caught” thought sampling, since subjects are asked questions after being interrupted or “probed”. Scientists
sometimes ask more fine-grained questions about subjects’ off-task thoughts, such as whether subjects are aware that they are off-task (e.g. Christoff, Gordon, Smallwood, Smith, and Schooler 2009). Given that my colleagues and I define mind-wandering as unguided thinking, we have also asked subjects whether their thoughts are guided or wandering from topic to topic (Mills, Raffaelli, Irving, Stan, and Christoff 2017). Using these self-report methods, psychologists have discovered much about the wandering mind, such as its neural foundations (e.g. Fox, Spreng, Ellamil, Andrews-Hanna, and Christoff 2015; Christoff, Irving, Fox, Spreng, and Andrews-Hanna 2016), consequences for education (Smallwood, Fishman, and Schooler 2007), and relationship to working memory (Smallwood and Schooler 2006; McVay and Kane 2010). As with dream research, self-report laid the foundations for a task-free psychology of mind-wandering.

3.3 Problems with Causal Inference

Scientists have made great progress towards a task-free psychology of dreaming and mind-wandering. Yet task-free methods have principled limitations that we must understand and address. One important limitation concerns causal inference: using task-free methods, it is difficult to make inferences about the effects of dreaming and mind-wandering. Put another way, it’s unclear how to design a task-free study where mind-wandering or dreaming is the independent variable (that is, the cause).

To understand this problem, we need some background on causal inference, both in general and within psychology. Suppose you want to know whether \( C \) causes \( E \). It’s insufficient to establish a correlation between \( C \) and \( E \) because, among other factors, correlation does not rule out the possibility that \( C \) and \( E \) have a common cause. For example, say you find that your barometer’s readings consistently change before a storm. Obviously, your barometer does not cause storms. Rather, barometer readings and storms are correlated because they have a common cause: changes in atmospheric pressure (Fig 2). Rather than relying on correlations, scientists determine whether \( C \) causes \( E \) by intervening on \( C \) (what follows is merely a sketch of the interventionist approach to causal inference; for book-length developments of this approach, see Woodward 2003, Spirtes, Glymour, and Scheines 2000, Hausman 1998; Pearl 2009). Roughly speaking, an intervention is a way to modify whether \( C \) occurs while leaving other potential causes of \( E \) constant. We can infer that \( C \) causes a change in \( E \) if and only if an intervention that changes \( C \) brings about the relevant change in \( E \). In our barometer example, an intervention would change our barometer’s reading while leaving atmospheric pressure constant. Of course, such an intervention would not lead to storms; from this, we can conclude that your barometers is not a rain maker.

Cognitive psychologists use tasks to intervene on cognitive processes, and thus study their effects. Think back to our toy example of an experiment from § 3.1. Subjects in the experimental condition make semantic judgments about

\footnotesize{
sometimes us other thought sampling methods. Subjects in “self-caught” thought sampling studies report whenever they notice off-task thoughts on their own (e.g. Schooler, Reiche, and Halpern 2004). Other experimenters interrupt subjects and ask them to freely report on their experiences (Morsella, Ben-Zeev, Lanska, and Bargh 2010). My arguments apply equally to all these thought sampling methods.
}
Table 2: Storms and barometer readings are correlated because of a common cause, namely atmospheric pressure

Psychologists cannot use tasks to activate dreaming or mind-wandering. How, then, can we study the effects of these processes? I’ll review three strategies, each of which has substantial limitations. The first strategy is to have subjects perform tasks immediately after they wake up from dreaming or mind-wandering. Stickgold et al. (1999) used this strategy to determine whether dreamers associate loosely connected concepts, which could explain why dreams jump between disconnected ideas. Stickgold et al. used a semantic priming task to measure how strongly two concepts are associated: subjects are first presented with a cue (e.g. ‘hot’) and then a target word (e.g. ‘cold’) or non-word (e.g. ‘cuwd’). Subjects are told to quickly classify the target as a word or non-word. Crucially, subjects typically respond faster to a target when its semantic association to a preceding prime is close (e.g. ‘hot’ after ‘cold’) rather than weak (e.g. ‘hot’ after ‘water’) or unassociated (‘hot’ and ‘window’) (see Neely 1991 for a review). Reaction times on the priming task are therefore a proxy for how strongly a subject associates two concepts.

Stickgold et al. predicted that dreaming would enhance the priming between concepts that typically display weak associations. One cannot, however, give subjects a semantic priming task while they are dreaming. Instead, Stickgold et al. exploited a phenomenon called “sleep inertia”, which is a dream-like state that lingers for a brief period after awakening. Specifically, subjects performed a semantic priming task immediately after they were woken from REM or NREM sleep or while they were fully awake. Stickgold et al. hypothesized that dreaming, and by extension REM-sleep inertia, would increase the priming between distant semantic associates. Their results support this hypothesis. Surprisingly, after REM sleep, distant semantic associations lead to stronger priming than close ones! Close associates

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*To make this causal inference, we would have to control for other factors, such as motivation and attention. Our toy example is therefore not meant to be an actual experimental design. Rather, it serves only to illustrate how one might use tasks to intervene on, and thus study the effects of, cognitive processes.*
display stronger priming in all other conditions. REM sleep inertia therefore seems to reverse some normal strength of associations between words.

But does this show that dreaming strengthens distant semantic associations? We should be careful here for two reasons, both of which contain general lessons about task-free causal inference. First, Stickgold et al. used REM sleep as a proxy for dreaming. But recall that REM sleep is neither necessary nor sufficient for dreaming: reports of dreaming are common in NREM sleep, as are reports of dreamless REM sleep (Windt 2015, § 2.1, 3.1; cf.§ 1). We therefore cannot know whether REM sleep inertia arises because of dreaming or an unconscious feature of REM sleep. Fortunately, this problem has an easy fix: after you wake subjects up, ask them whether they were dreaming. If Stickgold et al. are correct, then distant semantic associations should be stronger following self-reported dreaming as compared to dreamless sleep. The general lesson here is that dream reports should play a foundational role in task-free causal inference, just as they do in dream research generally.

Unfortunately, studies of sleep inertia have a second limitation that is harder to overcome. Suppose we find that distant semantic associations are stronger following self-reported dreaming. Even this correlation would be insufficient to establish that dreams causally influence associations. Causal inference typically relies on an intervention that changes the cause (in this case, dreaming) while leaving everything else constant. Due to the task-free methods of dream research, Stickgold et al. do not (and probably could not) use an intervention to initiate dreaming. At best, they can wake subjects up and ask them whether they have begun dreaming on their own. But then we cannot know what strengthens semantic associations: dreaming or whatever conditions lead subjects to begin dreaming on their own. Put another way, we cannot rule out the possibility that dreaming and distant associations have a common case (Fig 3). It’s hard to see how we can overcome this limitation, unless we find task-free methods to intervene on dreaming.

Psychologists have used a different strategy—one more akin to experimental intervention—to study the effects of mind-wandering on creative incubation (Wallas 1926). Creative incubation occurs when people make progress on a creative problem while performing an unrelated activity, such as taking a walk or showering (Sio and Ormerod 2009). Laboratory studies of incubation compare subjects who work on a problem continuously to those who work on the problem for a time and then return to it after a period of seemingly unrelated activity. Consider a hypothetical
experiment in which subjects perform the Unusual Uses Task, a canonical laboratory measure of creativity where subjects think of unusual ways to use ordinary objects like bricks or candles. Subjects in the incubation condition first think of unusual uses for a brick, next take a break to read an unrelated passage, and finally return to the problem. Subjects in the control condition come up with unusual uses continuously with no break. We would find an “incubation effect” if and only if subjects in the incubation condition outperform controls. Sio and Ormerod’s (2009) quantitative meta-analysis of 117 experiments found evidence of incubation effects on the Unusual Uses Task and other laboratory measures of creativity.

In an influential study, Baird et al. (2012) argued that mind-wandering can drive creative incubation. This idea has intuitive pull: when we’re stuck on a problem, for example, we may take a walk and let our minds wander from idea to idea until a solution suddenly pops into our head. Baird et al. tested their hypothesis by comparing the effects of three incubation periods, where subjects performed (1) an easy task, (2) a difficult task, or (3) sat quietly and rested. Baird et al. predicted that the easy task should be associated with the highest rates of mind-wandering, and therefore lead to the strongest incubation effects. Empirical evidence suggests that easy tasks induce more mind-wandering than difficult ones (Mason, Norton, Van Horn, Wegner, Grafton, and Macrae 2007; Smallwood, Nind, and O’Connor 2009; Baird, Smallwood, Mrazek, Kam, Franklin, and Schooler 2012). Furthermore, Baird et al. define mind-wandering as task-unrelated thought—that is, thought that wanders away from a task. So they assume that subjects’ minds do not wander at all when they sit quietly at rest.\footnote{I have argued that one’s mind can wander at rest (Irving 2016), as have Seli and colleagues (Seli, Risko, Purdon, and Smilek 2017). However, let’s grant Baird et al. this controversial assumption and ask whether, even then, their methods can reveal the effects of mind-wandering.}

As predicted, Baird et al. found that easy tasks lead to the highest incubation effects (Sio and Ormerod’s 2009 meta-analysis shows roughly the same result across studies).

Do Baird et al. show that mind-wandering causes incubation effects? We must again be cautious for two reasons, both of which contain general lessons about task-free psychology. First, if mind-wandering drives incubation, then individual subjects who report higher rates of mind-wandering should show larger incubation effects. But Baird et al. did not compare individual subjects based on their self-reported mind-wandering during incubation periods. Instead, they collapsed across groups, comparing those who performed easy and difficult tasks. Here the general lesson is the same as in sleep inertia: self-report should play a foundational role in task-free causal inference.

Second, Baird et al. do not establish that easy tasks cause creative incubation by causing mind-wandering. This second problem arises because the contrast between easy and difficult tasks is not an experimental intervention on mind-wandering. Interventions must not only change the cause you wish to study (in this case, mind-wandering), but also leave other potential causes constant. Compared to difficult tasks, however, easy tasks change many things other than mind-wandering. Easy tasks are more relaxing and less frustrating than hard tasks, for example. Sitting quietly and “resting” might also frustrate someone who is bored in an experiment. We could therefore give an alternative explanation of Baird et al.’s results: relaxation facilitates creative incubation, and frustration inhibits it. This is not an
isolated problem. Because Baird et al. did use an intervention to activate mind-wandering, there are any number of alternative explanations of the relationship between easy tasks and creative incubation. Similar problems face other manipulations that psychologists use to induce mind-wandering: for example, intoxication, inductions of negative affect, or manipulation of motivation (see Smallwood and Schooler 2015 for a review). None of these manipulations amount to a clean experimental intervention that we can use to study the effects of mind-wandering, since intoxication, negative affect, and motivation change many aspects of the mind other than mind-wandering.

How can we study the effects of dreaming and mind-wandering? Not easily. The challenge is to intervene on dreaming and mind-wandering, while leaving other aspects of the mind constant. This is daunting because we cannot use the standard task-based interventions of cognitive psychology. One place to look for a solution is the same interventionist theories of causation that I used to diagnose the problem of causal inference (e.g. Woodward 2003, Spirtes, Glymour, and Scheines 2000, Hausman 1998; Pearl 2009). Interventionists have spent a great deal of time on causal inference in fields like economics, which (typically) does not use experiments. Perhaps insights from this rich literature will help us to overcome the current limits of task-free psychology, to discover the effects of the passive mind.  

4 Conclusion

Windt likens philosophy to cartography (Windt 2015, Introduction; cf. Ryle 1949). I think this metaphor reveals much about Windt as a philosopher. Dreaming is in many ways the work of a map maker, an explorer. Windt travels into the conceptual frontier and leaves with a map of dreaming that is detailed, yet useable by expert dream researchers and novices alike. Windt’s greatest strength—her cartographic eye for detail—is on display when she turns to the methods of dream research. She moves through the methodological terrain with care, showing how all our ways to measure dreams depend on dream reports. I’ve argued that the methodological necessity of dream reports is not an isolated phenomenon. Rather, it is a symptom of the limits of task-based psychology: tasks are insufficient to study passive experiences such as dreaming and mind-wandering. Our alternative is to use self-report to measure passive parts of the mind. Admittedly, self-report comes with its own challenges, especially with respect to causal inference. Yet what

Jim Woodward (in conversation) helped me think through the possibility of interventions in task-free psychology.
choice to we have? Without self-report, our map of the mind will forever have a gap marked, “here be dragons”.  

References


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