Goal commitments and the content of thoughts and dreams: basic principles

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INTRODUCTION
The basic thesis of this article is that the thematic content of thoughts and dreams is determined, directly or indirectly, by the individual’s goals. This article answers, as far as the current state of research permits, the question of how we may predict the thematic content of waking thought, including rumination, and dreams. (1) An individual’s commitments to particular goals sensitize the individual to respond to cues associated with those goals. The cues may be external or internal in the person’s own mental activity. The responses may take the form of noticing the cues, storing them in memory, having thoughts or dream segments related to them, and/or taking action. Noticing may be conscious or not. Goals may be any desired endpoint of a behavioral sequence, including finding out more about something, i.e., exploring possible goals, such as job possibilities or personal relationships. (2) Such responses are accompanied and perhaps preceded by protoemotional activity or full emotional arousal, the amplitude of which determines the likelihood of response and is related to the value placed on the goal. (3) When the individual is in a situation conducive to making progress toward attaining the goal, the response to goal cues takes the form of actions or operant mental acts that advance the goal pursuit. (4) When circumstances are unfavorable for goal-directed operant behavior, the response remains purely mental, as in mind-wandering and dreaming, but still reflects the content of the goal pursuit or associated content. (5) Respondent responses such as mind-wandering are more likely when the individual is mentally unoccupied with ongoing tasks and less likely the more that is at stake in the ongoing task. The probability of respondent thought is highest during relaxed periods, when the brain’s default-mode network dominates, or during sleep. The article briefly summarizes neurocognitive findings that relate to mind-wandering and evidence regarding adverse effects of mind-wandering on task performance as well as evidence suggesting adaptive functions in regard to creative problem-solving, planning, resisting delay discounting, and memory consolidation.

Keywords: mind-wandering, goals, dreams, default-mode network, planning, creativity, memory, rumination

HISTORY AND SOME DEFINITIONS
Thematic content simply refers here to what the thought or dream is about, irrespective of the form in which it occurs, whether verbal or non-verbal, conceptual or imaginal, whether its representation of the content is fairly veridical, metaphoric, symbolic, or associated with the thematic content in some other discernible way. These latter dimensions of form raise a host of other questions, the answers to which have been little researched, are not as well understood, and are not addressed in this article.

While people are working on specific tasks, much of their mental content will, of course, relate to the momentary task. However, even during such operant task activity, mental content commonly shifts intermittently to other, respondent content (Klinger, 1971; Andrews-Hanna et al., 2010a), which has often been dubbed daydreaming or mind-wandering.

Modern scientific research on such shifts in thought can be considered to have begun in earnest with the experimental and psychometric work of Jerome L. Singer and John S. Antrobus (e.g., Singer, 1966). The terms operant versus respondent are taken from Skinner’s theory (Skinner, 1935, 1953) to refer to activity aimed at acquiring reinforcers (or goals) versus reflexive responses to stimuli, here including one’s own mental events.

Various investigators have applied varying operational definitions to daydreaming, such as thought consisting of fanciful content (Freud, 1953), being independent of current task activity (e.g., Singer, 1966), or being unintended and spontaneous, i.e., respondent (Klinger, 1971). As it turns out, when assessed by thought-sampling with participants’ self-reports and analyzed intra-individually, these three definitions are almost orthogonal...
What follows is shaped by two evolutionary considerations. First, any kind of activity that absorbs up to a half of conscious brain activity must have been selected for its contribution to the human species’ survival. Indeed, it appears that the brain’s default-mode network provides the substrate for mind-wandering (e.g., Mason et al., 2007; Christoff et al., 2009; Andrews-Hanna et al., 2010a; Stawarczyk et al., 2011b), a network of several “hubs” and “subsystems” (Andrews-Hanna, 2012) that probably constitutes a majority of the brain’s energy consumption (Raichle, 2009). It must serve important functions. These include a variety of mental processes, including retrieval of past experiences and imagining future scenarios (Buckner et al., 2008), which are essential for planning and are also stock components of mind-wandering sequences.

Second evolutionary consideration has to do with the fact that succeeding in goal pursuits is, for the Animal Kingdom, a categorical imperative. That is, all animal species at one or more of their life stages depend for their individual survival on successful pursuit of the substances and conditions necessary for life — a motile survival strategy. Furthermore, the survival of the species depends on individuals successfully pursuing the goals necessary for procreation.

It follows that every adaptation conferred on humans by the natural selection that produces evolution must have evolved in the service, direct or indirect, of successful goal pursuit. That would include respondent mental activity, such as mind-wandering. These two evolutionary considerations provide a backdrop for the following five principles that account for much of the variance in the thematic content of people’s thoughts.

A (definitional clarification. Goals may be any targeted end-point of a behavioral sequence, such as food, sex, sleep, a paycheck, an aesthetic experience, or finding out more about something, i.e., exploring potential goals, such as job possibilities or personal relationships. The brain’s processes underlying goal pursuit fit the conventional definition of motivation.)

PRINCIPLE 1: GOAL COMMITMENTS DETERMINE ATTENTIONAL FOCUS, RECALL, THOUGHT AND DREAM CONTENT, AND BEHAVIORAL FOLLOW-THROUGH

An individual’s commitments to particular goals sensitize the individual to respond to cues associated with those goals. These cues then receive automatic priority for cognitive processing. The cues may be external in the environment or internal in the person’s own mental activity and include cues related to failure to achieve a goal (Chatard and Selimbegovic, 2011, Study 6). The responses may take the form of noticing the cues, storing them in memory, having thoughts or dream segments related to them, and/or taking action. Noticing may be conscious or not.

One’s personal goals also provide an important basis for organizing one’s thoughts, including thoughts about one’s future (projection), and introducing goal-related cues appears to facilitate this process (D’Argembeau and Demblo, 2012). People are also more fluent in making up scenarios around specific goals than around specific persons or locations (D’Argembeau and Mathy, 2011). These investigators, however, instructed their participants to formulate scenarios about hypothetical future events. The responses were not primarily the mind-wandering — spontaneous, undirected thoughts — on which the remainder of this article will focus.

EFFECTS OF GOALS ON THOUGHT AND DREAM CONTENT

Early support for this view (Klinger, 1978; Hooblicher et al., 1981) demonstrated effects of goals on attention, recall, thought content, and dream content. Initial investigations of this model assessed participants’ concerns (the state of having goals, both positive-appetitive and aversive, as assessed there from extensive interviews and questionnaires) and a few days later asked participants to listen with moderate attention to what they were about to hear. The experimenters then played for them simultaneously two different
but similar audiotapec 15-min narratives, one narrative to each ear.
Throughout, participants could choose to which narrative they listened. Here and there, at particular time points on this tape, a few words going to one ear had been inconspicuously modified to relate to one of the individual participant's own goals, and, simultaneously, a few words going to the other ear had been modified to relate to someone else's goals, but not, so far as one could determine, to this participant's goals. The two modified passages in each such pair were matched on formal properties and designed to be syntactically compatible with the words they replaced. For example, for a participant who had the goal of entering a helping profession, the italicized words in the following passage were embedded into one of the narratives (original stream-of-consciousness fiction, *Texts for Nothing*, by Beckett, 1995, p. 101): "Who are these people anyway? What do they need, what can be done? Did they follow me up here..." The narrative passages in which the modified portion related to the participant versus to someone else varied quasi-randomly between the two narratives within each session.
Participants used a toggle switch to indicate points in time at which they switched the ear to which they were paying attention. This indicated at any given time to which narrative they were probably listening. Ten seconds after the end of each modified passage, the tape paused with a signal tone and participants reported what they were thinking about and what last content they recalled from the tape.

The results were powerful (Table 1): participants spent significantly more time listening to passages associated with their own goals than to passages associated with others' goals, recalled those passages about twice as often, and had thought content that (by ratings of judges blind to conditions) was related to passages associated with their own goals about twice as often as to the opposite passages (Klinger, 1978). The relatively small differences in time spent attending to the own-goal-related cues versus other cues is explainable by the fact that detecting such cues in an unattended channel requires the process of noticing them after a portion of the own-goal-related passage has already played, then switching attention to that channel and moving the toggle switch.

When participants listened to tapes that had been prepared for other participants, no effects on attention, recall, or thought content occurred, indicating that the embedded cues indeed corresponded to the goals of the individual participants. The fact that the cues were woven unobtrusively into their narrative contexts, with no particular tasks to be performed with them, suggests that they might have functioned in a way similar to unexpected environmental cues or even cues presented by the individual's own internal stream of consciousness.

Similarly, goal-related stimuli influence dream content much more reliably than do other stimuli. One investigation in a sleep laboratory using standard electroencephalography (EEG) and eye movement measures (Holtscher et al., 1981) administered a modified Concern Dimensions Questionnaire (CDQ; Klinger et al., 1980, 1981) to assess seven participants' goals, followed by four consecutive nights, an adaptation night and three experimental nights, during which, five to seven times per night during Stage 1-rapid eye movement (REM) or Stage 2 sleep, the experimenters

| Dependent variable | Types of cues | Percents of intra-subject variance accounted for by cue differences |
|--------------------|---------------|------------------------------------------------------------------|
|                    | Concern       | Non-concern                                                      |
| Waking subjects    |               |                                                                  |
| Time spent listening (seconds) | 74.6 | 58.9P | 762 |
| No. of passages per session recalled | 2.78 | 1.38c | 1706 |
| Passages per session thought about | 3.73 | 1.95c | 18.59 |
| Sleeping subjects  |               |                                                                  |
| Percent cues incorporated in REM sleep | 34 | 11c |

Note. Data for waking subjects are from Klinger (1978), Table V, p. 252. Significance values are for the differences between concern-related and non-concern-related means. The differences were tested by directional t-tests for correlated data, with each session’s mean difference between Concern and Non-concern conditions taken as the unit of analysis, adjusted to compensate for differing numbers of sessions per participant. The data are based on 88 sessions from 20 participants (72% percent of variance), but because of a Behrens–Fisher problem degrees of freedom used in significance testing were the most conservative number, 19 (2). Data in the bottom row from seven sleeping participants for 59 stimulus trials during REM over three experimental nights are from Holtscher et al. (1981), REM, rapid eye movement sleep. |
which sometimes was related to one of their individual goals, as assessed by a modified Short Motivational Structure Questionnaire (MSQ; Cox and Klinger, 2011) and sometimes it was related to a different person’s goals. Participants spent four consecutive nights in the laboratory: an adaptation night without awakenings, a baseline night with awakenings but no dream suggestions, and two experimental nights with the presleep suggestions. Half of the participants received own-goal instructions on Night 3 and instructions to dream about another’s goal on Night 4, with the other half receiving the reverse order of instructions. The instructions to dream about topics that were related to participants’ own goals significantly influenced dream content (as rated by judges blind to conditions), whereas instructions to dream about topics related to others’ goals did not. These results indicated that suggestions to dream about their own goals engaged participants’ attention, recall, and subsequent dream processing in a way not found with suggestions to dream about other topics.

Additionally, although the rate at which own-goal-related material appeared in dreams was lower during the baseline night, when no dream topics had been suggested, than when they had been suggested on an experimental night, dreaming related to own goals was still significantly more frequent (p < 0.01) than material related to others’ goals, which rarely occurred. This parallels the findings obtained with goal effects on waking thoughts, such as in mind-wandering. The processing priority conferred by having a goal—a current concern—continues to operate in dreams during sleep.

The results of the suggestion nights also demonstrated that dream content responded to sleepers’ presleep intentions, which would appear difficult for activation-synthesis theory to accommodate. The principal features of Hobson and McCarley’s (1977) original formulation of activation-synthesis theory are that (a) dream images are directly generated by essentially random, sporadic pontine discharges (the activation) that produce sudden radic pontine discharges (the activation) that produce sudden

or may not return to the same topic as previous segments. A median estimate of segment duration was 5 s in both settings, with a mean of 9 s in the laboratory setting and 14 s outside the laboratory (Klinger, 1978). These participants rated their confidence in their own estimates as “very confident” 64% of the time and as “moderately confident” 35% of the time. Pope (1977) asked participants in a laboratory to signal with a key press every time they mind shifted to a new topic, which happened on average about 5 or 6 s apart. This agrees very approximately with our own findings.

The implication is that mental content continually jumps from goal-related topic to goal-related topic in brief segments that may or may not return to the same topic as previous segments. A very rough estimate provides the generalization that waking mental activity over a 16-h day contains about 4,000 such thought segments (Klinger, 1990).

INTERFERENCE STUDIES OF AUTOMATIC PROCESSING PRIORITY FOR GOAL-RELATED CUES

The processing priority for goal-related cues has been shown using a variety of other cognitive methods. One is the use of quasi-Stroop procedures. In the classic Stroop procedure, under instructions to name the color of the font of words displayed one at a time as quickly as possible, participants typically respond more slowly when the meaning of the word conflicts with the color, such as green for the word RED. Similarly, reaction times (RTs) in reporting the font color of goal-related words are typically on average longer than they are to non-goal-related words (Johnsen et al., 1994; Riemann and McNally, 1995; Gilboa-Schechtman et al., 2009; Fadardi and Cox, 2008) or images. Presumably, the own-goal-relatedness of the word’s meaning grabs processing priority over identification of font color, thereby slowing reporting of font color. This processing priority could readily account for the tendency of conscious mental content in mind-wandering to gravitate toward material related to the individual’s own goals. The stimuli to cues relating to their goals, such as an experimenter speaking the address of a boyfriend. The participants remained asleep until awakened by the experimenters for their dream reports. These results identify goal-related stimuli as one of the triggers for individual mind-wandering and dream segments.

It is a matter of definition as to whether such segments could be considered self-generated, given that the cues were external. However, internal cues from a person’s previous stream of mentation might plausibly play a role similar to the external cues employed in the above experiments. Insofar as that is true, it answers provisionally one of the questions raised by Smallwood (2013a) regarding the determinants of when (“why”) self-generated thoughts begin: exposure to goal-related cues.

The thoughts evoked by cues and those occurring naturally do, of course, eventually end, and rather soon. Nobody has so far devised a satisfactory method for assessing when naturally occurring thought segments begin and end. The only method so far available is to rely on participants’ retrospective self-reports, which are bound to be fraught with error. However, a group of 20 participants trained to estimate brief time lapses rated the durations of the latest thought segments prior to probes, and of the segments just preceding those, in both laboratory settings and, for 12 of them, while living their otherwise normal daily lives. Their median estimates of segment duration were 5 s in both settings, with a mean of 9 s in the laboratory setting and 14 s outside the laboratory (Klinger, 1978). These participants rated their confidence in their own estimates as “very confident” 64% of the time and as “moderately confident” 35% of the time. Pope (1977) asked participants in a laboratory to signal with a key press every time they mind shifted to a new topic, which happened on average about 5 or 6 s apart. This agrees very approximately with our own findings.

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Young’s participants were to indicate as quickly as possible by pressing a button whether each occurrence of a letter string on a computer screen was an English word. The left side of the screen was taken up by a patch containing computer-related verbal “garbage,” which participants were instructed to ignore (and apparently did), but which sometimes contained a word related to one of a participant’s current goals. When the target string was indeed a word, this lexical judgment was slowed significantly if the distractor patch contained an own-goal-related word. Again, the point here is that encountering cues related in some way to one’s goals takes higher processing priority over competing cues in a way that helps to explain the gravitation of undirected thought content to one or another of the individual’s goals.

On the assumption that males are more likely than women to be concerned with power and hence be drawn to its cues, Mason et al. (2010) performed three experiments on responses of men and women to high-power versus low-power cues. These demonstrated that male participants dwelt longer on words relevant to power than on neutral words, were more distracted by high-power than low-power flanker words (i.e., had longer RTs to target stimuli), and were more likely to recall high-power-related than low-power-related names. Female participants did not display these biases of attention and memory. These results are consistent with those described above. Goal-related cues overtook others in processing priority.

BRAIN FINDINGS RELEVANT TO GOAL EFFECTS ON COGNITIVE PROCESSING

Recent brain-imaging studies have provided further support for this conclusion. Biezen et al. (2011) displayed single alcoholic beverages and four other kinds of images while assessing brain activity with magnetic resonance imaging (MRI) in light and heavy drinkers. In contrast to the light drinkers, the heavy drinkers responded in key cortical areas (right and left insula and ventral striatum) significantly more strongly than in response to neutral stimuli. This is consistent with the behavioral evidence that alcohol cues strongly draw the attention of heavy drinkers, for whom drinking is a frequent goal.

Consistent with these findings regarding the processing priority placed on cues related to goals, Franz (2012) has presented a neuroscientific model of brain organization and development, based largely on split-brain research, to support the conclusion that attention is controlled by intended actions and, at higher levels of organization, goals. He proposes “a multilevel system for the allocation of attention for action, in which the dopaminergic basal ganglia-thalamic-cortical circuits are integral... Notably, the present framework builds upon a highly dynamic system in which subcortical processes are central to the networks involved” (p. 12). Attention is thereby tethered to the brain systems responsible for central motivational processes.

An impressive proportion of thought samples obtained during mind-wandering have contained content that related to the individual’s goals, including spontaneous planning elements (Andrews-Hanna et al., 2010a; Stawarczyk et al., 2011a; Andrews-Hanna, 2012). In a retrospective questionnaire following their MRI sessions, participants using seven-point scales rated their spontaneous thoughts on average at about a goal-relatedness scale’s midpoint (4.16) and rated the thoughts’ personal significance above that (5.26); nearly half of these thoughts were considered to have focused on the past (19%) or future (28%); Andrews-Hanna et al. (2010a). Their MRI-based brain activity correlations indicated that besides the more established components of the default-mode network, such as the posterior cingulate cortex and medial prefrontal cortex, the medial temporal lobe plays an important role in supplying material for spontaneous thoughts from the individual’s past or prospective future (Andrews-Hanna et al., 2010a,b). Consistent with these findings, Ellamil et al. (2012) found elevated activity in the medial temporal lobes during generation of creative ideas.

While arguing vigorously for the adaptive nature of the default-mode network, Schacter (2012) observed that “in most studies that have linked default network activity with simulation of future experiences, the simulated future events are not linked to formulating a plan, solving a future problem, or any other kind of goal-directed cognitive activity. Instead, they represent imaginary scenes or scenarios that might or might not occur to the individual within a particular future time frame.” Unorganized as they may be, they serve up insights and planning components that can be assembled later into adaptive plans and action, as suggested by the incubation effect of experimentally induced mind-wandering in improving creative problem-solving (Baard et al., 2012). See also below under Principle 4.
Participants were instructed to ignore distractor stimuli, many currently preoccupy the subject. The two ratings were obtained subject’s important concerns, problems, worries, or goals that word”) and “the extent to which the word has to do with the strength of the subject’s emotional reaction to the content of the words: the word’s emotional “arousal potential” for them (“the individual correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 principal correlations between two kinds of their reactions to 40 conservative on his or her CDQ responses, in most cases masked by avoiding using participants’ own wording. Four other word clusters were drawn from a pool of other participants’ concerns with verification that they were not of concern to the particular participant, and 72 were filler clusters constructed to be formally like the concern clusters. The mean range-corrected proportional increase in skin conductance for intervals extending to 5 s after the end of stimulus clusters was 0.525 for concern clusters, 0.273 for non-concern clusters, and 0.174 for filler clusters. The difference between concern and non-concern clusters was significant with p = 0.025 and a Cohen effect size of 0.56. The difference in skin conductance between filler clusters and concern clusters was significant with p < 0.01.

Unfortunately, the experimenters subjectively suspected that 8 of the 19 Minnesota participants may have had at least some inkling of the hypotheses of this study, although this was not confirmed by participants’ statements. In any event, the skin conductance results for the 11 probably unaware participants were weaker than for the possibly aware participants and, taken by themselves, fell short of statistical significance (p < 0.05, two-tailed). This made it desirable to attempt a different kind of research design using a thought-sampling procedure. Instead of assessing arousal in response to goal-related and neutral cues constructed by the investigators (which participants may have recognized correctly as having been constructed for them individually), Experiments 2 and 3 investigated what was happening in participants’ consciousness as a function of skin conductance measures. In Experiments 2 (138 German students) and 3 (24 German students), the signal tones to rate thoughts during electrodermal measurement were sounded either when experimenters observed non-specific (i.e., unelicited) skin conductance responses (10 probes) or at control points (also 10 probes) in the absence of such spontaneous electrodermal activity, in quasi-random order. Experiments 2 and 3 differed only in the larger number of scales in Experiment 3 on which participants orally rated their thoughts.
at each sampling point. In Experiment 2, they rated the presence of a current concern (unfinished “activity or goal”), arousal, and imagery (“imagination”) in their thought content. These ratings were on a scale ranging from 0 (not present) to 5 (fully present).

The mean ratings for current-concern-relatedness were 2.18 after probes triggered by skin conductance responses and 1.88 after probes during electrodermally inactive periods (p < 0.001). Ratings of perceived arousal differed much less (p < 0.05) between these two sampling conditions and of imitation not at all. In Experiment 3, the ratings that reached significance at p < 0.05 were higher after probes triggered by skin conductance responses than during quiescent periods for current-concern-relatedness and for anxiety, and they were lower for presence of imagery. Together, these findings indicate through electrodermal measures that internally generated goal-related cues are either preceded or closely accompanied by emotional arousal. That the difference in ratings of arousal was weaker than those of concern-relatedness may indicate that the arousal is often not consciously experienced.

Also of interest in Experiment 3 was the rating variable for “dormant concerns” (“any activity or goal you have not finished or reached in the past which you are not pursuing currently”). Insofar as ratings of the presence of dormant concerns in thought samples differed by sampling conditions (p < 0.10), they were actually lower during skin conductance responses than during quiescent periods. This suggests that current goal pursuit, rather than just having the goal in one’s past conceptual repertoire, is necessary for arousal.

HEART RATE LEVELS AND THE FREQUENCY OF TASK-UNRELATED THOUGHTS

Another investigation (Smallwood et al., 2004) found evidence of substantially higher arousal as measured by heart rate for individuals who engaged in more frequent task-unrelated thoughts (TUTs). Although this investigation did not assess the relatedness of TUTs to individual participants’ goals or concerns, it is a fair assumption from other evidence that their TUTs were so related. Although the sample was small, the correlations between TUT frequency and heart rate were substantial. For three task conditions the ordinal correlations were 0.75 in a word-shadowing task (reading without memorization) and 0.28 in a word-study task (with memorization); the overall correlation for the combined tasks was 0.58. One possible implication is that goal-related thoughts during TUTs are associated with emotional arousal.

EEG EVIDENCE ON LATENCY OF PROTOEMOTIONAL RESPONSES TO EMOTIONALLY EVOCATIVE STIMULI: IMPLICATIONS FOR CONTROL OF ATTENTION

Although the studies above demonstrate an association between emotional arousal and cues of one’s goals, they provide no evidence regarding the temporal sequence of this association. However, EEG evidence is at least suggestive, in the form of associations between responses to emotionally evocative stimuli – both words and pictures – and positive deflections in the EEG trace in a band beginning at about 300 ms after stimulus onset (the P300 response). This nomenclature is reviewed elsewhere (Kinger, 1996). Its implications are that the processing of emotionally loaded material begins about a third of a second after stimulus onset. Because of its association with the emotionality of stimuli at a point when the arousal is not yet conscious, I have dubbed this kind of response protomotional.

In this view, the protomotional response constitutes a first step in processing of stimuli; whether processing continues, and whether it eventually engages other bodily systems, such as circulatory, glandular, pulmonary, or intestinal activity, depends on conditioned responses and cognitive assessments of the importance, valence, and expectancies of whatever it is that the stimuli represent. Insofar as emotionally evocative stimuli are also goal-related stimuli, having a goal—a current concern—controls much of what it is to which people attend.

MOOD, MIND-WANDERING, AND RUMINATION

There is one more kind of association involving emotion. There is evidence that inducing negative moods increases mind-wandering, perhaps because it potentiates personal concerns (Smallwood et al., 2009a). When internal cues are associated with threat, they may set up a repetitive sequence of ruminative thoughts. (For a full review of repetitive thought, see Watkins, 2008.)

The findings described above provide a ready explanation for ruminative sequences. For example, an individual is concerned about one or more important goals, such as keeping a relationship or a job, and feels anxious about the many details involved in these, such as the many things necessary for keeping the other person or the boss happy while meeting one’s own needs and desires. With high enough values placed on these goals and subgoals, the individual’s own thought stream provides a continuing source of internal cues that trigger one after another of the individual’s emotional reactions to, and self-generated thoughts about, the various aspects of the goal pursuit. If this concern is more potent emotionally than most of the person’s other concerns, the network of reactivity is likely to keep the individual’s thoughts within the domain of the highly valued concern, as each thought segment triggers another related to the same broad domain or to related domains, with plenty of repetition. Hence one ruminates.

Furthermore, it appears that negative moods tend to skew mind-wandering toward past events (Smallwood and O’Connor, 2011; Smallwood et al., 2011). Once the person has extracted all of the lessons offered by these past events, further repetition is unhelpful, and the rumination is likely mainly to lower mood even further. Individuals with personalities high in negative affect are particularly vulnerable to this pattern. Apart from nulling the past, the individual, under the pressure of prospective loss or failure, may already be somewhat depressed, and the emotional tone of the ruminative sequences is likely to deepen that depression even further (Nolen-Hoeksema et al., 2008).

It is important not to confuse these findings with an impression sown by the title and summary of an article by Killingsworth and Gilbert (2010), that mind-wandering as such lowers mood. That is not what their data actually showed. Their participants rated 42.5% of their mind-wandering episodes as about something “pleasant,” with mood then averaging slightly above the overall mood average, roughly equaling mood when not mind-wandering. They rated 31% of the remaining mind-wandering episodes as about something “neutral,” with average
When the individual is in a situation conducive to making progress, Expected Utility theory in economics. This theory, together with other subsumes under the idea is intuitively obvious, but its elaborations become complex. Whether a person views a situation as conducive to pursuing a particular goal depends on a decision process that takes into account the anticipated relative gains and losses arising from a particular course of action in comparison with alternative courses of action possible in that situation. An elaborate research area has grown up around this decision process, which one can generically denote as the goal-directed action, this network becomes active more broadly than simply during mind-wandering or simply in the absence of operant activity. It is activated during states of unfocused external attention (Stawarczyk et al., 2010) or perceptual decoupling (Smallwood, 2013a), when attention is turned away from perceptual senses, regardless of whether the turning away is part of a respondent sequence. Moreover, this activity cannot be accounted for by task-related interferences or external distractions (Stawarczyk et al., 2011b). In a compelling experimental dissection, Smallwood et al. (2013b) reported that degree of activation of core regions of the default-mode network (medial prefrontal cortex and posterior cingulate cortex) was associated with faster RTs in simple laboratory tasks that required focusing on memory (the numerical value of a previous stimulus) but was associated with slower RTs when the task required focusing on current stimuli (whether the present number was odd or even). The important point for present purposes is that the activated default-mode network may facilitate an operant response that depends on an internal focus, such as retrieval from memory. Previous evidence using less focal behavioral activities is consistent with these findings. For example, Spreng et al. (2010) found activation of the default-mode network during autobiographical planning, which entails both retrieval of memories and imagining the future, thus turning attention inward, but not during a visuospatial planning exercise, an adaptation of the Tower of London puzzle, in which attention is turned outward. Earlier, a meta-analysis by Spreng et al. (2009) had found that the default-mode components during autobiographic memories, prospection (imagining the future), navigation (imagining one’s location and how to move within it), and theory of mind (taking another person’s perspective). These results clearly suggest that the default-mode network is activated during a variety of perceptually decoupled mental activities. It thus appears that although the respondent components of mind-wandering may depend on the default-mode network, they are far from the only activity supported by that network. When tasks make large demands on processing, the necessary shift of mental resources from the default-mode network to executive regions is harder to attain with advancing age (Persson et al., 2007). Mind-wandering activity is also modulated in accordance with the factors described below under Principle 5.

To sum up this section, under circumstances conducive to doing something about one’s goals, mind-wandering declines but the default-mode network on which it depends remains active in relation to inner-focused mental activities, such as retrieval from memory or imagining a future scenario. The operant thoughts and actions that replace mind-wandering are, of course, directed at the individual’s goals. Some of these may be intrinsically satisfying ultimate goals, but others may have been imposed on the individual by the need to satisfy other individuals or circumstances that wield some control over access to the person’s intrinsically satisfying goals, such as a partner or a war.

PRINCIPLE 4: WHEN CIRCUMSTANCES ARE UNFAVORABLE FOR GOAL-DIRECTED OPERANT BEHAVIOR, ACTIVITY BECOMES LARGELY MENTAL, AS IN MIND-WANDERING. WHAT FOR?

When circumstances are unfavorable for goal-directed operant behavior, whether in action or thought, the response to cues of a goal remains largely mental, as in mind-wandering and dreaming, but still reflects the content of the goal pursuit or thematically associated content. The evidence for the goal-relatedness of such respondent mentation is discussed above under Principle 1 (e.g.,
Although such respondent mental content is generally conscious, it may occur without current awareness. For example, when people were asked to indicate whenever they were aware of having mind-wandered, those reports were much less frequent than the mind-wandering that was found to take place with experience-sampling probes (Schooler et al., 2011). Furthermore, extent of activation in various brain regions of the default-mode network differs somewhat according to whether individuals are aware or unaware of their mind-wandering.

One reason that people mind-wander much more than they are aware of doing may be that mind-wandering and the meta-awareness of doing so engage some of the same brain structures, such as the anterior prefrontal cortex, so that when occupied by mind-wandering these structures cannot also create awareness of the mind-wandering (Schooler et al., 2011). Thus, energy goes into mind-wandering without the mind-wanderer being aware that it is going on.

**BENEFITS OF MIND-WANDERING**

Why would our species have evolved such extensive mind-wandering? Actually, this state of not thinking directly appears to confer a number of benefits for cognitive functioning (Christoff et al., 2011). This section reviews evidence regarding its functions.

**PLANNING FOR GOAL PURSUITS**

First among these is the role of mind-wandering states in advancing people toward their goals. Thus, thought samples indicate that the content of mind-wandering includes planning elements, which strongly suggests it fulfills a planning function (Baird et al., 2011; Stawarczyk et al., 2011a), even though its components are spontaneous and fragmentary.

**CREATIVE PROBLEM-SOLVING**

Second, mind-wandering appears to promote creative problem-solving that is productive toward attaining one’s goals. There are numerous anecdotal reports of important creative insights attained during states that foster mind-wandering (e.g., Klinger, 1990; Singer, 2009). Early on, Singer and Schonbar (1961) had found that a psychometric, self-report measure of how much graduate students in education daydreamed correlated 0.48 with the degree of creativity the students displayed in their account of an “actual daydream” and in a “spontaneous, original story” that they wrote. Reviewing the challenges one faces, as in mind-wandering, promotes the incubation of creative problem-solving in a way that improves subsequent performance. Thus, interposing an opportunity for mind-wandering (during an undemanding task) between two administrations of Unusual Uses problems leads to better subsequent performance in solving those problems on a second try than after interposing a demanding task that discourages mind-wandering (Baird et al., 2012).

Consistent with these findings, the brain regions of the default-mode network substantially overlap those that come into play in the early stages of creative thinking about something, such as the medial prefrontal cortex. However, creative thinking also eventually requires evaluation of one’s ideas, which involves other regions, such as the lateral prefrontal cortex (Christoff et al., 2011).

**MIND-WANDERING AND DELAY-DISCOUNTING**

There are further likely benefits of mind-wandering. It appears that people whose minds wander more than others are also likely to display more patience with receiving rewards and hence make better decisions. Smallwood et al. (2013a) measured mind-wandering with probes for TUTs during an undemanding or a demanding task. Subsequently participants engaged in a “delay-discounting” task. Delay discounting measures the extent to which people settle for smaller immediate rewards rather than wait for larger, delayed rewards. For example, in the study by Smallwood et al. (2013a), participants were given a choice of receiving €10 immediately or a larger reward (ranging from €12 to €50) at from 1 to 180 days later. Considering only the undemanding task, which permitted considerable mind-wandering, those whose minds wandered more than others also were more likely to choose one of the larger but later rewards than the small immediate reward. In this correlational design, it is impossible to establish causal direction. Does tending toward more mind-wandering provide more opportunity for reflection or more insulation from distracting external stimuli, as Smallwood et al. (2013a) suggest, thereby leading to sounder decisions? Or does a more restrained decision process or greater trust elicit more mind-wandering? Or are both attributes attributable to some more fundamental property of personality? In any event, mind-wandering is here associated with making sounder choices.

**MEMORY CONSOLIDATION DURING MIND-WANDERING**

Finally, there may be a memory consolidation benefit of “offline” waking thinking that is similar to, although weaker than, the well-documented memory consolidation that takes place in sleep. For example, Ellenbogen et al. (2007) trained participants on the alleged rank order of six stimuli that were composed of different color patterns (e.g., Pattern B > Pattern C). The training consisted of learning the ordinal relationships between pairs of these stimuli that were of adjacent ranks. Later, the participants were given unanticipated tests of ordinal relationships between stimuli that were different by two ranks (“one degree of separation”) or three ranks (“two degrees of separation”). This task required participants to exercise inference—to extrapolate from what they had learned during their training experience. With only a 20 min interval after training, participants had little ability to perform this extrapolation task. After 12 or 24 h, however, their performance improved considerably. For the 12-h groups, improvement was roughly similar for inferences across one degree of separation regardless of whether the time interval included a night’s sleep. However, participants who slept during part of the assigned
The probability of spontaneous-seeming respondent thought is highest during relaxed periods, when the brain’s default network predominates (Mason et al., 2007; Christoff et al., 2009; Andrews-Hanna et al., 2010a), or during sleep. After all, the default network was discovered as a result of researchers in brain-imaging studies observing regularities in brain activity when participants were between their assigned tasks (Raichle et al., 2001), and the mental activity during those task-free episodes was found to be largely mind-wandering (Mason et al., 2007).

**A GROUND-BREAKING INVESTIGATION**

An early investigation (Antrobus et al., 1966) that obtained thought reports after brief signal-detection trials established a number of other conditions. First, the rate at which participants had to make judgments and the difficulty of the task (detect a tone of a particular frequency versus detect a change in frequency from the previous tone) both significantly affected reports of task-irrelevant thoughts. That is, the more demanding the task, the less minds wandered.

Second, when the investigators instituted money penalties of differing sizes for missing target signals, higher penalties led to fewer reports of task-irrelevant thoughts (This finding actually applied only to the male participants, for reasons that are unclear).

Third, between sets of such trials in their Experiment 5 the investigators (Antrobus et al., 1966) exposed half of the participants to a radio broadcast of mostly music that was ostensibly interrupted by an (untrue) announcement that the Communist Chinese had just entered the Vietnam war, which was then really in progress, and that U.S. draft boards were calling up all eligible men (untrue at that time). Given the implications of such a development for the male participants, many of whom would have been subject to the military draft, and for participants’ friends and relatives, this procedure clearly instigated or elevated a current concern. The effect on the subsequent set of signal-detection trials was clear: compared with the control group, strongly increased rates of reported task-irrelevant thoughts. Later inquiry revealed, unsurprisingly, that many of the TUTs by participants in the experimental condition related to the impact on them of the supposed entry by the Chinese into the war. Here the manipulation was not of what was at stake in participants’ performance but rather what was at stake in external events, which surely relegated task performance to relative irrelevance.

Finally, Antrobus et al. (1966) reported that the rate at which participants reported task-irrelevant thought steadily increased over trials. This was presumably an effect of fatigue, or perhaps also of boredom.

**TASK DIFFICULTY AND MIND-WANDERING**

Subsequent research has confirmed these conditions that govern the tendency for minds to wander. One prominent determinant, as in Antrobus et al. (1966), is task difficulty, which can be operationalized as a baseline task of simply fixing attention on a point on a screen versus varying degrees of perceptual load or working memory load. Giambra (1985) found TUTs more frequent with less demanding vigilance tasks. He reports on other experiments with similar effects, but the difficulty of the reading tasks they used appears not...
to have affected the frequency of TUTs. Difficulty levels of texts may affect TUTs differently than more controlled, brief task units. Feng et al. (2013) found more TUTs with difficult than with easy texts and also worse comprehension. It may well be that when texts become sufficiently difficult, readers have trouble maintaining the stream of absorbing the text meaningfully, with correspondingly more frequent lapses into mind-wandering.

One way to vary load without changing tasks is by giving participants varying degrees of practice with a task. This is the approach taken by Mason et al. (2007), who found mind-wandering (operationalized as stimulus-independent thoughts (SITs)) most frequent at baseline rest, less frequent with well-practiced tasks, which are to some extent automatized by the practice and hence require less conscious control than novel tasks, and least frequent with novel tasks. Activity levels of the default-mode network varied with the task conditions similarly to SIT rates. These relationships between patterns of brain activity and mind-wandering were confirmed and extended by Christoff et al. (2009), who combined the MRI procedure with simultaneous thought probes during a go/no-go task.

The investigation by Mason et al. (2007) also found significant correlations during well-practiced tasks between MRI readings of activation in six regions of the default-mode network and scores on the self-report psychometric measure of the individual’s typical inner experience. With little variation across the six recording sites, the mean of the correlations was 0.58, the mean of the peak correlations was 0.72. These strong correlations both validate the daydreaming frequency scale of the IPI and establish the close association of the default-mode network with mind-wandering, which is one form—most likely by far—the largest of daydreaming. (The connection is close but not exclusive. See above the work by Christoff et al. [2009], Smallwood et al. [2010], Spreng et al. [2010], and others.)

There were a number of partial precedents for these findings. SITs associated with medial prefrontal cortex (McGuire et al., 1996), similarity in activation patterns during rest and semantic retrieval (Binder et al., 1999), increased task difficulty leading to increased deactivation of some regions associated with the default-mode network (McKiernan et al., 2003) and (b) to decreased self-reported TUTs (McKiernan et al., 2006). In each case the investigators suggested that the stimulus-independent and task-unrelated thoughts may represent the kind of self-generated or self-oriented thoughts common in mind-wandering.

Forster and Lavie (2009) varied perceptual load, defined here operationally as, for example, detecting a letter on a screen surrounded by letters that look similar to the target letter, a task that requires close inspection of the various letters, versus letters that look quite different from the target, in which the target letter is easily discriminable. The greater the perceptual load required to perform tasks, the less participants’ minds wandered.

Andrews-Hanna et al. (2010a) have shown that both reports of spontaneous thought and activity in the default-mode network are substantially greater in relatively passive states (fixation on cross-hairs) than during more demanding tasks (detecting subtle visual flickers on a screen). This investigation also found a number of important features linking activity in various brain regions to the content of spontaneous thought. Especially, activity in the medial temporal lobe correlated with default-mode activity when participants reported thinking about something in the past or the future. This leads to the inference that the medial temporal lobe relays long-term memories to the default-mode network’s thought stream.

T easdale et al. (1995) examined the relationship of three components of working memory to SITs (although stimulus independence and task-unrelatedness are, from the standpoint of self-ratings, virtually uncorrelated dimensions (Klinger and Cox, 1987–1988), both have been used by various researchers to operationalize daydreaming or mind-wandering). One component of working memory is the “phonological loop,” whose relation to SITs was assessed by having participants memorize sequences of digits by speaking them versus having them simply repeat a set sequence of digits without any need to remember them. As compared with quiet conditions, both of these procedures significantly reduced the number of SITs by half or more.

In a second experiment, T easdale et al. (1995) examined a second component of working memory, the visuospatial sketchpad, operationalized as tapping keys on a keyboard in specified orders. Participants in all three conditions had to decide whether displayed sentences were silly. Compared with a quiet condition, conditions in which they also tapped their fingers more than halved the number of their SITs.

A third experiment investigated the effects of having practiced a task, which consisted either of tracking a point on a pursuit rotor or memorization of digits. Practice permits some automatization of task behavior and hence relieves the need for conscious control. There were fewer than half as many SITs while performing novel compared with practiced tasks.

Finally, in a fourth experiment, T easdale et al. (1995) examined the role of central executive resources in frequency of SITs. They did this not by counting SITs but by assigning a task of continuously generating random numbers, which were recorded, and then examining lapses from randomness in the 20 numbers generated before a thought probe. They then compared these indices of randomness according to whether the probe elicited a SIT or a report of “not thought” (NT). On the assumptions that generating random numbers is difficult enough to make significant demands on central executive processes, and that central executive resources are necessary for producing SITs, T easdale et al. (1995) hypothesized that lapses from randomness would be more frequent before SITs than before NTs. They confirmed this hypothesis, with a difference of a bit less than half a standard deviation.

T easdale et al. (1995) concluded that SITs require central executive resources, and that the suppression of SITs during the various tasks results from competition for those resources. This formulation is consistent with the generalization that mind-wandering occurs less often during more demanding tasks. What it does not explain is why, in the absence of task activity, the brain automatically reverts to the default-mode network, and why mental activity automatically reverts to mind-wandering, as the baseline, default states of brain and mind. McKiernan et al. (2006) varied three dimensions of task difficulty: stimulus presentation rate, perceptual discriminability, and short-term memory load, each at three levels that were considered
easy, moderately difficult, and difficult. The difficulty levels were reflected in corresponding differences in accuracy and time on target, thus verifying the manipulation of difficulty. In all but one of the tested regions, increased difficulty led to increased deactivation of some regions subsequently associated with the default-mode network. Even the easiest conditions produced some significant deactivation. McKiernan et al. (2003) attribute this effect to an automatic shift of brain resources from the cognitive processes active at "rest" to those necessary to perform the assigned tasks.

Besides the observations that mind-wandering was more frequent during relaxed states or work on undemanding tasks, under these conditions self-generated thoughts were more often focused on the future than on the past (Klinger and Cox, 1987–1988; Smallwood et al., 2009b, Smallwood et al., 2011; Baird et al., 2011). Under more demanding conditions, this prospective bias disappeared (Smallwood et al., 2009b). Also, working memory capacity has been reported inversely associated with everyday mind-wandering during resource-demanding activities (Kane et al., 2007), positively related to proportionally prospective mind-wandering during an undemanding task (Baird et al., 2011), but unrelated to proportionally prospective mind-wandering during demanding tasks (McVay et al., 2013). In the latter condition, perhaps the drain on working memory saps its availability for building scenarios of the future.

**MOTIVATION — WHAT THE PERSON HAS AT STAKE IN PAYING CLOSE ATTENTION**

With regard to the effect on mind-wandering of what people have at stake, Kool and Botvinick (2012) examined the amount of time participants spent on a demanding or an undemanding task in sessions in which they could freely shift from one to the other. Demanding-task trials, which, based on previous evidence, presumably reduced the opportunity for mind-wandering, were rewarded with candy pieces, whereas trials with undemanding tasks were not rewarded at all. Participants were allowed to switch back and forth between the two types of task within sessions. In a second session 1–2 weeks later, some participants were told that their candy “wages” had increased and others were told that they had decreased. The time they spent with demanding tasks decreased after a wage decrease and increased after a wage increase. The fact that these participants chose some unrewarded trials is consistent with having a need for freer mental activity, as in mind-wandering, and the shift toward more unrewarded trials when the wages for rewarded, demanding trials decreased indicates that mind-wandering decreases when there is more at stake in the assigned task.

Mind-wandering has a well-established inverse relationship to a variety of performance measures (e.g., Smallwood et al., 2004; McVay and Kane, 2012a,b; Smallwood, 2013b), including reading comprehension (Smallwood et al., 2003, 2007, 2008; Smallwood and Schooler, 2006; McVay and Kane, 2009; Smallwood, 2011; Mrazek et al., 2012). Unsworth and McMillan (2013) thought-sampled TUTs and obtained laboratory measures of working memory capacity and a number of self-report measures: motivation for the task, interest in the topic, and previous experience with the subject matter. They found that, of these, motivation for the reading task was the strongest predictor (−0.61) of the TUT measure of mind-wandering, and mind-wandering was the strongest predictor (−0.58) of reading comprehension. In combination with the findings of Kool and Botvinick (2012) and the original findings of Antrobus et al. (1966), it is clear that, unsurprisingly, mind-wandering gives way to sufficiently important external demands.

When one speaks of goals, goal neglect, and the interference of TUTs with performance, the reference is usually to experimenter-assigned goals that are likely to be of limited importance to the experimental participants. As Antrobus et al. (1966) found when they levied money penalties for inattention (missing target signals), incentives affect TUT rates. It would be interesting to investigate the relation of TUTs to working memory capacity or executive attention, and to task performance, under higher-incentive conditions. Would high-TUT participants then be equally disadvantaged as they have been in the investigations reported hitherto?

**EFFECT OF TASK OR ACTIVITY DURATION**

As Antrobus et al. (1966) found, the incidence of TUTs increased with task duration. Smallwood et al. (2002–2003) reported a similar effect for much briefer task periods, interrupting participants after 30, 45, or 60 s with a thought probe. When participants’ tasks were relatively easy to perform, the rate of TUTs increased as a function of duration. This effect did not occur with a task of thinking up words that begin with a particular letter of the alphabet, which requires sustained controlled effort. Other investigators that have reported a similar increase in TUTs as a function of task repetition or duration include Andrews-Hanna et al. (2010a), Stawarczyk et al. (2011a, Experiment 1), McVay and Kane (2012a), and Unsworth and McMillan (2013). None of these investigations obtained direct measures of fatigue or boredom, but it is a reasonable inference that mental fatigue with repeated processing in an operant task might temporarily deplete brain resources, much as has been reported in the literature on ego-depletion (e.g., Baumeister et al., 2000; Baumeister, 2002; Vohs et al., 2013).

**THE TUSSEL BETWEEN MIND-WANDERING AND ATTENTION TO THE EXTERNAL WORLD**

Mind-wandering may be the baseline, default mental state, but it is in continuous competition with the need to process what goes on beyond the individual brain. Many species could survive without that external attention. McKiernan et al. (2003) have shown with fMRI analyses that a variety of task-related variables – stimulus presentation rate, perceptual discriminability, and short-term memory load – in each case contributed to deactivating the default-mode network. They proposed that this happens by diverting attention, which is a limited resource, toward the external task.

Nevertheless, the default-mode network apparently corresponds to the true default mental state in the absence of demands for operant activity by tasks and goals. An essential question is the mechanism for switching between these two attentional orientations. Spreng et al. (2010) proposed a three-network model of how this happens: the default-mode network, the dorsal attention network, and a frontoparietal control network. The first two have “an intrinsic competitive relationship” whereas the third serves “as a cortical mediator linking the two networks in support of...”
goal-directed cognitive processes” (Spreng et al., 2010, p. 383; conceptually extended by Smallwood et al., 2012). That is, Spreng et al.’s (2010) fMRI results showed the frontoparietal control network to be activated during both autobiographical (inner-focused) and visuospatial planning (in an adaptation of the Tower of London game). That suggests that the frontoparietal control network plays a key role in the switch back and forth.

A GREAT DEBATE

For some years now, there has been a lively, constructive debate regarding this switching process. This debate has been most recently summarized by Smallwood (2013a), who has also suggested a resolution among four main viewpoints: the goal theory of current-concerns (e.g., Klinger, 1971, 1975, 1977, 2009; Klinger and Cox, 2011; and the sections above), decoupling from failure (e.g., McVay and Kane, 2009, 2010, 2012a,b), and meta-awareness (Schooler et al., 2011; becoming conscious of one’s mind-wandering, a self-regulatory process). Smallwood proposes separating explanations for the occurrence of mind-wandering from explanations for the process of mind-wandering once it has started. Of the four approaches, only the decoupling approach is relevant to process, in the sense of the continuity and integrity of a thought train. The other three approaches relate to the initiation (“occurrence”) of a mind-wandering thought train. Therefore, decoupling from perception complements rather than conflicts with the other three as an account of mind-wandering.

Smallwood (2013a) is correct in stating that the current concerns/goals theory is about the way in which thought segments start and has little to say about how segments continue or end. Decoupling, on the other hand, addresses a condition necessary to protect an ongoing train of thought from disruption by perceptual demands. Thus, it picks up the theoretical account where current concerns theory leaves off. Furthermore, Smallwood views executive control functions as a “domain-general resource” that is active in organizing and regulating both externally oriented activity and mind-wandering. This view is consistent with the views of such investigators as Teasdale et al. (1995) and Spreng et al. (2010), although the latter view (and that of Smallwood et al., 2012) has evolved from an executive control network to two networks: a dorsal attentional network that is “anticorrelated” with the default-mode network (i.e., when activity levels in one network rise, activity levels in the other fall), and a frontoparietal control network that can join with either one of the other two, depending on task needs, to bestow processing priority. Spreng et al. (2010) focused on mental planning activity. However, as already indicated, mind-wandering, even if somewhat erratic, frequently relates to planning.

The strong evidence for perceptual decoupling raises a further question regarding the processes involved in protecting the integrity of segments of behavior—that is, of relatively integrated response sequences that lead from the decision to act (or the start of a thought train) to the intended endpoint of the sequence (see also Franklin et al., 2013; Smallwood, 2013b). That launching such a sequence instates an inhibition of interruptive factors seems clear. External interruptions of on-going behavior before some logical endpoint or pause “leads to visceral arousal” and emotional upset (Mandler, 1964, p. 163). The entire literature on emotional accompaniments of extinction of operant behaviors attests to this (e.g., Klinger, 1975, 1977). The expectation that accustomed sequences of behavior will end as usual seems ingrained in people from an early age. EEG evidence with event-related potentials indicates that infants as young as nine months react with N400 deflections (negative deflections after 400 ms post-stimulus) when sequences they observe end unexpectedly (Redd et al., 2009). Perceptual decoupling may, accordingly, be part of a more extensive process that protects ongoing behavior (see also Klinger, 1971, 2011, in regard to a meaning-complex theory of response organization; also behavioral chunking, e.g., Perlman et al., 2010).

McVay and Kane’s conceptualization (e.g., Kane and McVay, 2012; McVay and Kane, 2012b), on the other hand, features proactive executive control that keeps people focused on their goal pursuits, from which mind-wandering distracts. Indeed, mind-wandering detracts from performance of many ongoing tasks (Schooler et al., 2011). In an extensive individual differences investigation employing structural equation modeling, TUTs mediated effects of executive attention and working memory capacity on reading comprehension with a coefficient of −0.44 (McVay and Kane, 2012a). Executive control is anticorrelated with the default-mode network (e.g., Buckner et al., 2008); mind-wandering thus represents a transient “failure” of the executive control network rather than a potentially adaptive switch to another network.

Smallwood (2010, 2013a) questions this executive-failure view on a number of grounds. First, the content of mind-wandering is internally organized, may be persistent, and hence probably also requires support from an executive control system that supports both attention to a task and the integrity of thought trains that have wandered away from it. Second, mind-wandering interferes with processing of both task-relevant and task-irrelevant cues, suggesting a briefly stable perceptual decoupling that redirects attentional resources to the ongoing stream of thought and is to that extent impervious to distraction from external stimuli. Third, in that individual differences study of the relationship between mind-wandering and reading comprehension (McVay and Kane, 2012b), measures of trait attention control and working memory capacity predicted performance, but after controlling for this, TUTs still accounted for an additional 8% of the variance in comprehension errors, thus suggesting that mind-wandering affects task performance beyond the role of (executive) attention control, presumably because of perceptual decoupling that accompanies mind-wandering (Smallwood, 2013a).

As indicated, perceptual decoupling can be considered applicable to thought process (protecting the integrity of the thought stream), whereas the three other approaches apply to initiation of thought segments. In that case, it would appear that decoupling complements the other three rather than conflicting with them. However, the relationship among them is more complicated than that. Failure of executive control during an ongoing task would represent the beginning of a mind-wandering episode, but reassertion of executive control would require an intrusion on the mind-wandering, breaking through the decoupling shield to refocus on external reality—a re-coupling of perception. To that extent, these processes would be in conflict. As a further complication,
if, as Smallwood (2013a) suggests, mind-wandering itself requires executive resources, are there then two strands of executive control that come into conflict with each other? Perhaps, but this seems a bit un parsimonious.

One conceptual possibility is that momentary shifts in incentives, in the form of actual or anticipated affect regarding the direction of attention (outputs) or a task with minimal demands, with corresponding shifts between external perception or action and the fostering of thoughts. The decision function could be similar to that operating in choices among alternative actions (e.g., Knutson et al., 2005; Tobler et al., 2005). Rather than a failure of executive control, this would entail a flexible executive that moves attention to whatever focus appears at the moment optimal not only for task performance but also for brain refreshment and for all of the other reasons that the default network’s role in spontaneous cognition. J. Neurophysiol. 104, 322–335. doi: 10.1152/jn.00830.2009

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