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Spontaneous Thought and Vulnerability to Mood Disorders: The Dark Side of the Wandering Mind

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Abstract

There is increasing interest in spontaneous thought, namely task-unrelated or rest-related mental activity. Spontaneous thought is an umbrella term for processes like mindwandering, involuntary autobiographical memory, and daydreaming, with evidence elucidating adaptive and maladaptive consequences. In this theoretical framework, we propose that, apart from its positive functions, spontaneous thought is a precursor for cognitive vulnerability in individuals who are at-risk for mood disorders. Importantly, spontaneous thought mostly focuses on unattained goals and evaluates the discrepancy between current and desired status (Klinger, 1971, 2013a). In individuals who stably (i.e., trait negative affectivity) or transitorily (i.e., stress) experience negative emotions in reaction to goal-discrepancy, spontaneous thought fosters major cognitive vulnerabilities (e.g., rumination, hopelessness, low self-esteem, and cognitive reactivity) which, in turn, enhance depression. Furthermore, we also highlight preliminary links between spontaneous thought and bipolar disorder. The evidence for this framework is reviewed and we discuss theoretical and clinical implications of our proposal.

Keywords: spontaneous thought, mindwandering, involuntary autobiographical memory, daydreaming, current concern, negative affect, stress, depression, rumination, hopelessness, self-esteem, cognitive reactivity, mindfulness, bipolar disorder, mania, Default Mode Network

“The fact that the body is lying down is no reason for supposing that the mind is at peace.

Rest is [...] far from restful”

Lucius A. Seneca (~60 A. D.)

Introduction

Spontaneous thought (ST) is a very frequent and ubiquitous phenomenon. Although modern life is considered busy and hectic with little spare time, estimates consistently suggest that we spend up to half of our waking thoughts thinking of and reflecting upon topics that are unrelated to the task at hand or the surrounding environment (Killingsworth & Gilbert, 2010; Klinger & Cox, 1987-1988). Moreover, ST has been robustly associated with both negative and positive emotional consequences (Andrews-Hanna et al., 2013; Killingsworth & Gilbert, 2010; Klinger, 2013b), as well as personality traits that have been implicated in risk for psychopathology (Zhiyan & Singer, 1996-1997). Notwithstanding these findings, so far only a few theoretical efforts have attempted to understand whether and how ST specifically impacts mental health and what role it may play in major psychopathologies, such as major depression and bipolar disorder (e.g., Andrews-Hanna, Smallwood, & Spreng, 2014; Klinger, 1996a; Watkins, 2008).

There are good reasons to examine ST in relation to mood disorders. First, negative self-focused thought is a hallmark characteristic of major depression, which most frequently arises when one is not fully engaged in a task. Second, as depression has been associated with lower levels of behavioral activation (Mazzucchelli, Kane, & Rees, 2009), there is ample opportunity to engage in ST. Third, considering that more than 32 million adults in the US have been estimated to be clinically depressed (Kessler et al., 2003) for a total cost to society of about \$83 billion (Greenberg et al., 2003), it is timely to elucidate whether and through which mechanisms ST impacts mood, cognition, and depressive symptoms.

Spontaneous thought and cognitive vulnerability to depression

ST is the mind's drifting away from external reality in an undirected and effortless manner (Christoff, 2012), during which individuals focus mostly on mentation associated with their unattained personal goals and evaluate the discrepancy between their current and desired status (see discussion of the function of ST below; Klinger, 1971, 2009, 2013a). If such goal-discrepancy processing recurrently elicits negative emotions, such as in individuals with a high level of trait *negative affectivity* or exposed to intense levels of *stress*, maladaptive consequences are expected. In our framework (Figure 1), we propose that negative emotional reactivity within ST could support and amplify four major cognitive risk factors for depression, which are (i) *rumination*, (ii) *hopelessness*, (iii) *low self-esteem*, and (iv) *cognitive reactivity*.

Building on previous literature (Klinger, 2009; Watkins, 2008), we propose that, under certain circumstances, ST could lose its open, expansive, and adaptive nature (McMillan, Kaufman, & Singer, 2013), when its dynamics narrow into a repetitive, thematically homogeneous, and negatively valenced thinking style. However, research indicates that in many circumstances, ST conveys important benefits, such as creative problem solving, autobiographical planning, and goal-reminding (Mooneyham & Schooler, 2013; Smallwood & Schooler, 2015). Thus, ST seems to function as a *precursor*¹ carrying multiple outcomes, some adaptive whereas others are clearly undesirable. Precisely elucidating under which circumstances and how ST has depressogenic consequences is the aim of the current paper.

Importantly, the cognitive risk factors that we link to ST emerged from independent theories of depression and are to a large extent investigated independently. In our view, these different cognitive risk factors can be associated at least partially as they share the same precursor, that is ST, which amplifies them and provides a necessary context in which these risk factors flourish and impact mental health. This mirrors recent meta-analytic evidence suggesting that cognitive

vulnerabilities to depression share a common etiologic factor (Hong & Cheung, 2015). We also propose that ST, especially when steered by negative affectivity or stress, could reduce the individual's ability to be attentive to the present moment and to adopt a non-judgmental attitude with regard to his/her negative thoughts and emotions; that is, negative ST could reduce *mindfulness*.

Resting state and ST (i.e., mindwandering) are the focus of intense efforts in both psychological and neuroscience research (Smallwood, 2013; Smallwood & Schooler, 2006, 2015). Therefore, our framework is informed by new developments in cognitive as well as neurobiological studies. Several investigators have emphasized the importance of integrating these different perspectives in the context of depression (e.g., Disner, Beevers, Haigh, & Beck, 2011; Marchetti, Koster, Sonuga-Barke, & De Raedt, 2012). What follows describes first the current understanding of ST, and specifically its functional and neural characteristics; second, we review the literature that links ST to depression and depressive symptoms; third, theoretical and empirical links between ST and the aforementioned risk factors (i.e., rumination, hopelessness, low self-esteem, and cognitive reactivity), as well as its interaction with mindfulness; fourth, briefly the possible role that ST plays in mania. Finally, we suggest future directions to guide new research and discuss the implications of our framework for clinical interventions.

Spontaneous Thought

Definitions and methodological issues

It is a common experience that the content of thought is often unrelated to any external stimulus. For instance, while reading a book, we may suddenly realize that we are unable to remember what we have been reading. However, the phenomenology of drifting thoughts is varied and hard to define precisely (Table 1). Although tentative taxonomies have been put forward, many of the terms used are characterized by roughly similar subjective reports (Singer & McCraven, 1961; Stawarczyk, Majerus, Maj, Van der Linden, & D'Argembeau, 2011), by a common neural substrate

(Stawarczyk, Majerus, Maquet, & D'Argembeau, 2011), and, importantly, by significant covariation (e.g., Mason et al., 2007; Mrazek, Smallwood, & Schooler, 2012). Therefore, given the substantial similarities between these phenomena, we use an umbrella term that represents all of these mental states, namely *spontaneous thought* (Antrobus, Singer, & Greenberg, 1966; Christoff, 2012; Christoff, Ream, & Gabrieli, 2004; Klinger, 1971, 1990, 2009).

Spontaneous thought (ST) can be defined as “unintended, nonworking, noninstrumental mental content that comes to mind unbidden and effortlessly” (Christoff, 2012, p. 52; Klinger, 2009). Under this definition ST is a non-instrumental type of thinking that overtly serves no deliberate function, such as calculating. Furthermore, it encompasses different types of thoughts, such as mindwandering unrelated to the task at hand, daydreaming during periods of wakefulness, and involuntary recollection of personal memories. Although an early experience sampling study shows that these phenomena can be differentiated (Klinger & Cox, 1987-1988), they all share important features, such as being decoupled from ongoing perceptual input, being internally rather than externally focused, and supported by the same underlying mechanism, namely self-generated thinking (Andrews-Hanna et al. 2014). In sum, the adopted definition of ST is a broad one, but it has the benefit of taking into account different facets of the same class of thoughts that, according to participants' report, switch from one to another in the normal thought-flow (Klinger, 1978; Pope, 1977, as cited in Klinger, 2013a). Given this, to provide a comprehensive framework and strengthen the theoretical foundations of our model, we capitalize on different research lines, such as (i) *mindwandering*, (ii) *involuntary autobiographical memories*, and (iii) *daydreaming*.

Mindwandering is probably the largest component of ST (Klinger, 2009), and is defined as “a shift of attention away from a primary task toward internal information” (Smallwood & Schooler, 2006, p. 946). Thus, attention is decoupling from external reality in favor of internally generated information during task engagement. Although many ways have been proposed to capture this phenomenon (Mooneyham & Schooler, 2013), of particular interest are attention-based tasks, such

as the Sustained Attention to Response Task (SART; Robertson, Manly, Andrade, Baddeley, & Yiend, 1997). This task involves a slow-paced GO/NOGO task, during which the participant is to respond by pressing a button to frequent non-target stimuli and to withhold a response to infrequent target stimuli. Often during SART intra-task thought probes ask about specific qualitative/quantitative features, such as off- vs. on-task thoughts occurring just before the probe. Both self-reports (i.e., off-task thoughts) and behavioral markers (i.e., commission error and pre-error reaction times) are usually counted to indicate mindwandering (Table 1).

Involuntary autobiographical memories, which arise without intention to retrieve them (Berntsen, 2009), by definition, belong to the superordinate category of ST (Johannessen & Berntsen, 2010). In cognitive research, two methods are used most often to investigate this phenomenon: naturalistic diary studies and vigilance tasks (Berntsen, 2009; Vannucci, Batool, Pelagatti, & Mazzoni, 2014). Diary studies entail either online or retrospective recording of frequency and content of involuntary autobiographical memories occurring in everyday life (i.e., Rubin & Berntsen, 2009). Vigilance tasks consist of sustained attention-based tasks during which participants are to detect specific infrequent targets among frequent non-target stimuli. Importantly, participants are also exposed to task-irrelevant cue-phrases that are expected to trigger involuntary autobiographical memories (e.g., Vannucci et al., 2014).

Daydreaming is defined as “a shift of attention away from an ongoing physical or mental task or from a perceptual response to external stimulation toward some internal stimulus” (Singer, 1966, pp. 3). This definition includes inner experiences, such as fantasy in layman’s terms, but excludes intentional activities, such as writing or working. Moreover, the content of daydreaming seems mostly to be of imaginative nature, as Singer (1966) claimed that daydreaming involves “[...] ‘pictures in the mind’s eye,’ the unrolling of a sequence of events, memories, or creatively constructed images of future events of various degrees of probability of occurrence” (p. 3). Daydreaming has been investigated by means of different methodologies (for a review see,

McMillan et al., 2013), including self-report questionnaire assessment and thought probing. The 344-item Imaginal Processes Inventory (IPI; Antrobus, Singer, Goldstein, & Fortgang, 1970) is the principal self-report assessment for daydreaming, with its 12-item subscale about the frequency of daydreaming being used increasingly (Mason et al., 2007; Stawarczyk, Majerus, Van der Linden, & D'Argembeau, 2012). Moreover, further analysis revealed the existence of three main daydreaming styles (Huba, Aneshensel, & Singer, 1981), that is, poor attentional control (e.g., "I have difficulties maintaining concentration for long periods of time"), positive-constructive daydreaming (e.g., "My daydreams often leave me with a warm, happy feeling"), and guilty-dysphoric daydreaming (e.g., "In my fantasies, a friend discovers I have lied"). A more direct alternative to retrospective trait self-report assessment, has been to administer thought probes during both conscious resting periods and normal everyday lives. This permits investigating the specific content of ongoing mental activity (Killingsworth & Gilbert, 2010; Klinger, 1978; Klinger & Cox, 1987-88) and the underlying attentional focus (Marchetti, Koster, & De Raedt, 2013; Vanhaudenhuyse et al., 2011).

In sum, ST includes a variety of mental activities that are diversely conceptualized, but all share essential features. These include lack of conscious intent to initiate the thought or image, temporary decoupling of attention from external stimuli, same neurobiological substrate, and being goal-related (see subsequent discussion of evidence for this point). As expected, different ST-related markers significantly covary in terms of frequency and content. Specifically, trait daydreaming frequency, as measured by the IPI, correlates with DMN activation during well-practiced versus more difficult tasks (Mason et al., 2007), frequency of involuntary autobiographical memories (Berntsen, Rubin, & Salgado, 2015), and frequency of behavioral and self-reported instances of mindwandering (Mrazek, Smallwood, & Schooler, 2012; Stawarczyk et al., 2012). It is also worth mentioning that in the same individuals mindwandering, as measured by thought-probing, is correlated across different tasks (Unsworth & McMillan, 2014), and that negative daydreaming

content seems to emerge in a similar way in involuntary future prospection (Finnbogadóttir & Berntsen, 2013). However, the observed correlations between these constructs are typically moderate, suggesting that these constructs capture shared as well unique aspects of ST. Without equating one phenomenon with the other, this substantial correlation justifies treating the concept of ST as a common class of involuntary thoughts.

Basic properties of spontaneous thought

ST can be characterized along several dimensions, some of which are of crucial interest for their clinical impact, such as (i) *frequency*, (ii) *neurobiological substrate*, (iii) *self-focus*, (iv) *temporal projection*, (v) *valence*, (vi) *processing style*, and (vii) *(reduced) attentional control*.

First, ST is reportedly a frequent occurrence that occupies up to half of our mental activity during waking time (Franklin et al., 2013; Killingsworth & Gilbert, 2010; Klinger & Cox, 1987-1988), with about 2000 out of 4000 daily thoughts dedicated to ST (Klinger, 1990).

Second, ST has been strongly associated with a specific neural network, the Default Mode Network (DMN). The DMN is a large-scale network that has been reported to be highly active during rest and less active (if not deactivated) during external attention-demanding tasks (Raichle et al., 2001). It comprises different brain areas, such as the medioprefrontal cortex (MPFC), the perigenual anterior cingulate cortex (pACC), the posterior cingulate cortex (PCC), the retrosplenial cortex (Rsp), the precuneus, along with more lateralized areas, such as the lateral parietal cortex (LPC), the mediolateral temporal cortex (MLTC) and (para)hippocampal formation (Andrews-Hanna et al., 2014). Importantly, Mason et al. (2007) reported that during a well-practiced task, higher levels of BOLD signal in the DMN were associated with higher levels of daydreaming frequency.

Third, ST tends to be focused on the self (Green, 1923). This claim has been confirmed by recent experimental and experience sampling studies in different cultures (Song & Wang, 2012). This is also corroborated by neurobiological findings showing that specific DMN areas lying on the

brain midline, such as the MPFC and the PCC, have been directly involved with self-processing (for a meta-analysis, see Qin & Northoff, 2011).

Fourth, ST also involves temporal self-projection. Most studies report a prospective bias toward the future (Baird, Smallwood, & Schooler, 2011; Song & Wang, 2012; Stawarczyk, Majerus, Maj, et al., 2011). Interestingly this tendency is sensitive to manipulation, as both self-reflection and personal goal processing can strengthen it (Smallwood, Schooler, et al., 2011; Stawarczyk, Majerus, Maj, et al., 2011), whereas negative mood leads to self-projection into the distant past (Poerio, Totterdell, & Miles, 2013; Smallwood & O'Connor, 2011). However, a closer look at the data also indicates that about 40% of ST centers on the present (Andrews-Hanna, 2012). Interestingly, Spreng and Grady (2010) showed that autobiographical memory and future prospection share the same neurobiological substrate, such as the ACC, PCC, and (para)hippocampal formations.

Fifth, emotionality and ST have been shown to influence each other in a reciprocal and complex way (Varendonck, 1921). Experimental manipulations for increasing negative mood enhance levels of mindwandering (Smallwood, Fitzgerald, Miles, & Phillips, 2009), whereas an experience-sampling study suggested that being off-task might enhance future levels of unhappiness (Killingsworth & Gilbert, 2010), but Klinger (2013b) argues and Poerio et al. (2013) present data to show that affect reflects the content of ST, rather than ST as such. From a neurobiological standpoint, a recent meta-analysis provided evidence that ST and socioemotional processing partially rely on common brain areas belonging to the DMN, such as dorsal MPFC and precuneus (Schilbach et al., 2012).

Sixth, recent perspectives highlight the important role played during ST by abstract vs. concrete processing style (McVay & Kane, 2010; Watkins, 2008). Abstract processing is characterized by higher-order representations of actions and events that the individual is aiming at, involving a decontextualized and general perspective (i.e., the “why” of certain events). In contrast, concrete style entails the processing of contextualized and specific details about the means necessary

to reach important goals (i.e., the “how”). Recent studies highlight that differences in abstract vs. concrete processing during ST are associated with emotional well-being and prospective thinking, with more abstract ST being related to trait rumination and focus on distant future scenarios (Andrews-Hanna et al., 2013; Stawarczyk, Cassol, & D’Argembeau, 2013).

Seventh, fluctuations in ST have been reliably associated with attentional control and task performance, with ST usually being related to poor performance on paradigms requiring external attention (Barron, Riby, Greer, & Smallwood, 2011; Hu, He, & Xu, 2011; McVay & Kane, 2009; Smallwood, Beach, Schooler, & Handy, 2008; for an extensive review, see Mooneyham & Schooler, 2013). However, the exact nature of the relation between internal and external focus is still under debate (McVay & Kane, 2010; Smallwood, 2013; Smallwood & Schooler, 2006). Recent evidence suggests that, on the one hand, ST (especially its mindwandering component) and external distraction partially share a common underlying mechanism of reduced attentional control (Unsworth, Brewer, & Spillers, 2012); on the other hand, once an off-task thought has started, cognitive resources are recruited to maintain the internal train of thought and insulate the individual from possible external interference (Smallwood, Brown, Baird, & Schooler, 2011; Unsworth & McMillan, 2014). There is ample evidence that these cognitive control patterns, when carried to excess, are linked to undesirable outcomes, such as vulnerability to depression (Koster, De Lissnyder, Derakshan, & De Raedt, 2011).

Spontaneous thought as a goal reminder mechanism

Considering the frequency of ST and its links to the individual’s cognitive-affective system, one question arises: What is the function of ST? Klinger (2009) proposes that ST reflects prospective goal-directed actions that are as yet uncompleted, especially if they are blocked but not yet relinquished. Let us explain this in greater detail.

Goal pursuit is the key factor on which individual action is based (Carver & Scheier, 1998; Klinger, 1975, 1977). Human beings are committed to different and, sometimes, contradictory goals, which are organized into hierarchies ranging from lower- to higher-order goals. The latter are closer to an abstract view of the self, which represents what the person wants and aspires to be (Carver & Scheier, 1998). For each of these goals, the process begins with commitment to it (e.g., finding a new job) and it ends with either its attainment or disengagement (e.g., getting a new job vs. giving up looking for new employment). Throughout this process, emotional reactivity plays a crucial role in choosing the goals, monitoring their pursuit, directing cognitions to enhance the chance to successfully attain them, and finally evaluating the outcomes (Klinger & Cox, 2011). The basic mechanism whereby a specific goal is chosen among a virtually unlimited variety of possible goals can be accounted for by the Value x Expectancy framework (Feather, 1982; Van Eerde & Thierry, 1996). This approach states that the determinants of commitment reside in the joint evaluation of the emotional change (i.e., increase of positive emotions and/or decrease of negative emotions) due to goal attainment and the subjective probability of being able to attain that goal. In other words, both the expected emotional payoff and the optimism about attaining it play a crucial role in choosing a specific goal. Once committed, though, there is no way back, in that the possible outcomes are represented by either successful goal attainment, which leads to satisfaction, happiness, and positive mood, or disengagement from it, whose emotional consequences range from disappointment to severe depression (Klinger, 1975; Klinger & Cox, 2011). There have been many critiques and modifications of the basic Value x Expectancy model, but most models of choice employ one of its variants. Furthermore, neuroscience has added specific neural support for its components (i.e., Knutson, Taylor, Kaufman, Peterson, & Glover (2005)).

Crucially, the time between the beginning and the end of goal pursuit is where a *current concern* operates (Klinger, 1971, 1975, 2009). This is a latent state (i.e., “having a goal”; Klinger, 2009, pp. 229) that sensitizes the individual to any information associated with the particular goal-

striving process by steering his/her cognitive functions (e.g., perception, attention, and memory). In other words, the current concern arises from the discrepancy between the actual state and the desired outcome state (i.e., feedback mechanism), and it promotes the processing of information relevant to moving toward the latter (i.e., feedforward mechanism).

From these ideas, it follows that ST serves as a *reminder mechanism* regarding an individual's hierarchy of goals (Klinger, 2013a, b). When not engaged in immediate and demanding tasks, one's mind gravitates overtly or covertly toward unaccomplished goals that have not been relinquished and are still relevant. Research shows that thematically homogeneous ST segments are usually brief, with an estimated median duration of 5s and an estimated mean duration of 14s (Klinger, 1978), meaning that content keeps shifting. Ordinarily, these shifts are toward content that may be associated with the previous segment, but also can run the gamut of an individual's current concerns. Not only is there reason to believe that these shifts are primarily directed by emotional reactions to external and internal cues (Klinger, 1996b, 2013a), but also that the extent to which a cue is related to a current concern is strongly correlated with the emotional responses the cue elicits (e.g., Bock & Klinger, 1986; Nikula, Klinger, & Larson-Gutman, 1993). More specifically, positive affective reactions to concern-related cues usually signal perceived progress toward or imminent attainment of goals or a condition that allows the processing of further unaccomplished goals. In a positive state, the associative network activated during ST turns out to be open and expansive, in other words, the individual's mind "wanders" through different topics (Bar, 2009; Klinger 2013a; Watkins, 2010). In contrast, a negative affective reaction to internal cues implies that the goal is far from being reached and, consequently, an enhancement of the goal processing priority is demanded, in order to reduce the discrepancy between current and desired state (Klinger, 1971, 1978, 2013a). Moreover, if negative affect associated with the goal is intense, as, for instance, in the case of prospective failure, the chain of ST will likely unfold around a fixed theme and the breadth of the associative pathways will be substantially narrowed.

It is now comprehensible why ST is very frequent, self-focused, temporally sensitive, emotionally valenced, and supported by different processing styles. Current concerns are likely to entail the processing of higher-order and self-centered goals, as suggested also from cognitive and neuroimaging literature (Qin & Northoff, 2011; Song & Wang, 2012). Although the content of ST often depicts positive and desirable concrete events, ST is frequently associated with a worsening in mood (Song & Wang, 2012), as it reminds one of what has not yet been attained. Nevertheless, as a consequence of Klinger's hypothesis (2009), if specific STs are helpful for reaching goals, the associated emotion should be positive as a marker that the attainment of the goal is likely or imminent. In line with this, Franklin et al. (2013) reported that off-task periods classified either as "interesting" or "useful" are characterized by more positive mood. Moreover, the matching between personal goals (i.e., desired states) and current state determines the most appropriate processing style: abstract thinking is adaptive when goal-attainment seems within reach and concrete thinking is required in the case of slow or blocked goal-discrepancy reduction (Watkins, 2008). Finally, in the state of undirected thought, executive resources are necessary to maintain the internal train of thought and prevent its disruption by events in the external world (Smallwood, Brown, et al., 2011; Schooler et al., 2011).

A large literature directly links current concerns to ST (Andrews-Hanna, 2012; Antrobus et al., 1966; Gold & Reilly, 1985-1986; Johannessen & Berntsen 2010; Klinger, 1971, 1975, 1978, 2009; Klinger, Barta, & Maxeiner, 1980; Poerio et al., 2013; Stawarczyk, Majerus, Maj, et al., 2011). Moreover, at the neural level, Christoff et al. (2009) reported that task-unrelated thoughts during the SART were supported not only by higher levels of DMN activation, but also by increased activity in the dorsolateral prefrontal cortex (DLPFC), a fact that may represent effort to maintain the internal train of thought and to address unattained goals during task-unrelated thoughts (Christoff et al., 2009; see Discussion).

In sum, ST is a complex mental phenomenon that, by means of its multiple features, supports and maintains several vital functions. One of the most important is that of reminding and maintaining active in the mind important goals, thereby increasing the chances to accomplish them successfully (Klinger, 2013a). Nevertheless, even highly adaptive mechanisms may sometimes carry maladaptive functions, and ST is no exception (Klinger, 1996a; Smith, 1904). Given its complex interplay between cognition, affect, and motivation, ST could convey undesirable effects and, in turn, foster depressive outcomes in at-risk individuals.

Spontaneous Thought and Cognitive Vulnerability to Major Depression

Spontaneous thought, DMN, and depression are documented to be associated in case reports (Beck, 1970; 1971/2004), correlational (Deng, Li, & Tang, 2012; Epel et al., 2013; Farrin, Hull, Unwin, Wykes, & David, 2003; Golding & Singer, 1983; Giambra & Traynor, 1978; Greicius et al., 2007; Johannessen & Berntsen, 2010; Meyer, Finucane, & Jordan, 2011; Stawarczyk et al., 2012), (semi-)experimental (Marchetti, Koster, & De Raedt, 2012; Smallwood, O'Connor, Sudbery, & Obonsawin, 2007, Stawarczyk, Majerus, & D'Argembeau, 2013), and predictive studies (Feldman & Hayes, 2005). Despite this solid evidence, the mechanism through which depression and ST are associated is still unclear.

The present theoretical formulation suggests that emotional reactivity to concern-related cues is a key mechanism in accounting for adaptive or maladaptive consequences from ST (Figure 1). When an individual has emotionally highly potent and self-salient concerns, it is likely that having mentally wandered into processing one of them will be associated with a comparably powerful emotional reaction (Nikula et al., 1993). The occurrence of a negative affective reaction to cues will affect the processing priority of goal-related cues, implying that subsequent thought segments will probably remain in the same or closely related content area (Klinger, 2013a). In other words, a powerful and negative emotional reactivity to internal cues has the capacity to lock the train of thoughts into a thematically narrow content channel (i.e., *funneling effect*; Clore & Gasper, 2000)

and to substantially reduce the breadth of the associative network. Consequently, if this funneling effect is the predominant way to react to these concern-related cues, maladaptive consequences are expected to occur, such as increased levels of *rumination*, *hopelessness*, *low self-esteem*, and *cognitive reactivity*.

Different conditions can influence the likelihood of experiencing this funneling effect, both in a stable (i.e., trait) or transitory (i.e., state) way (Figure 1). Among the factors that could stably influence emotional reactivity during ST, *negative affectivity* (NA) seems to be a good candidate to play a major role. NA is a highly stable and heritable trait disposition to experience negative emotions (Tellegen et al., 1988), such as sadness, fear, anxiety, hostility, scorn, and disgust (Watson & Clark, 1984), and it has been reliably associated with distress disorders, such as major depression (Clark, Watson, & Mineka, 1994). However, its role in ST has rarely been addressed (for notable exceptions, see Klinger, 2013a; Mason, Brown, Mar, & Smallwood, 2013). The proposed model suggests that high-NA individuals tend to overestimate the goal-discrepancy during ST, so that intense negative emotions are consistently elicited by processing of concern-related cues. By preferentially energizing the associative pathways linked to the unaccomplished goal, ST is bound to result in thematically homogeneous and negatively valenced associative processing and, in turn, to perpetuate maladaptive styles of thinking, such as rumination, hopelessness, low self-esteem, and cognitive reactivity.

Preliminary support for this model is offered by several studies. For instance, Andrews-Hanna and colleagues (2013) reported that individuals with high-NA/depressive symptoms experience more negative ST. In keeping with this, it is the negatively toned content of mindwandering that leads to subsequent negative mood, rather than mindwandering *per se* (Poerio et al., 2013). Finally, in a study investigating the relationship between daydreaming styles, personality traits, and affect, analysis revealed that guilty-dysphoric daydreaming, neuroticism, and NA significantly and highly loaded on the same factor (Zhiyan & Singer, 1996-1997). In sum, this evidence speaks in favor of

considering trait NA and its related facets (e.g., neuroticism) as a key mechanism in ST in order to account for undesirable consequences.

The present theoretical formulation suggests that transitory emotional states, especially when intense, also may steer cue-related emotional reactivity and channel the flow of ST into a narrower and more negative associative network (Figure 1). *Stress* is expected to facilitate such a funneling effect, by temporarily amplifying the perceived discrepancy between current and desired state, and favoring the elicitation of negative mood. In line with this, a study showed that frequency of current concern-related thoughts is influenced by stress in the form of blocked goals (i.e., unexpected difficulties in pursuing the goal; Klinger, Barta, & Maxeiner, 1980). Moreover, Stawarczyk, Majerus, and colleagues (2013) demonstrated that an increase of stress-related negative mood was correlated with task-unrelated thoughts in a subsequent SART, and, more importantly, they found that the amount of stress-focused thoughts during the experimental paradigm predicted persistence of negative mood, suggesting that negative mindwandering leads to maladaptive outcomes. Finally, an early study documented that, after anger induction, being allowed to engage in ST led to reduced anger toward the experimenter but increased self-awareness and self-blaming. This effect was particularly evident in individuals who habitually engage in ST (Pytkowicz, Wagner, & Sarason, 1967).

This evidence clearly suggests that ST is a mental precursor for multiple possible outcomes, which may or may not all be adaptive. In fact, due to stable and/or transitory negative emotional reactivity, ST could represent the ideal ground that spurs the amplification of cognitive risk factors (*amplification hypothesis*; Watkins, 2008). Specifically, the frequent occurrence of ST, in the form of a negatively valenced, thematically homogeneous, and associatively narrowed network of thoughts, could trigger such undesirable phenomena. Moreover, in the context of mindwandering, ST has been hypothesized to engage cognitive resources in order to support the internal flow of

thought and to shield the person from external interference, which leaves fewer resources for exerting control over the content of ST (Schooler et al., 2011).

Given that cognitive risk factors for depression share specific features with undirected thoughts, we propose that fluctuations of ST in terms of *frequency*, *content*, and *processing style*, along with *negative emotional reactivity* and *reduced cognitive control*, will result in related fluctuations of rumination, hopelessness, low self-esteem, and cognitive reactivity (Figure 1). Finally the occurrence of even transitory depressive symptoms will, in turn, enhance the negative emotional reactivity to internal cues and establish a positive feedback loop between ST and undesirable outcomes (Marchetti, Koster, & De Raedt, 2012; Meyer et al., 2011). This notion is supported by an early study reporting positive correlations of depressive symptoms with frequency of, absorption in, and frightened reactions to daydreaming as well as with the tendency to experience daydreams characterized by feelings of guilt and fear of failure (Giambra & Traynor, 1978).

The next sections discuss evidence for the proposed link between ST and four major cognitive risk factors: rumination, hopelessness, low self-esteem, and cognitive reactivity. To increase the nomological validity of our framework, we also highlight the inverse relationship between (affectively negative) ST and mindfulness, a well-established protective factor against depression.

Rumination

Rumination is a form of repetitive self-focus that leads to and exacerbates depressive symptoms (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Rumination has been conceptualized in different ways, such as a trait vs. context-dependent process and triggered by either negative mood or goal nonattainment (Smith & Alloy, 2009). The most influential theory is the response styles theory (RST), which defines rumination as “behaviors and thoughts that focus one’s attention on one’s depressive symptoms and on the implications of those symptoms” (Nolen-Hoeksema 1991, pp. 569). According to this theory, individuals react to negative mood by initiating ruminative

processing with the aim of enhancing their self-understanding, which unfortunately leads to a paradoxical increase in negative mood (Lyubomirsky & Nolen-Hoeksema, 1995). Within the RST, two specific ruminative subtypes have been defined and are worth mentioning: reflective pondering and depressive brooding (Treyner, Gonzalez, & Nolen-Hoeksema, 2003). Reflective pondering is considered the less maladaptive form of rumination as it reflects the extent to which individuals try to improve their mood by focusing on the problem. Brooding is considered the more detrimental form of rumination, as it represents “a passive comparison of one’s current situation with some unachieved standard” (Treyner et al., 2003, p. 256).

In the proposed model, ST represents the ideal forum for the occurrence of depressive rumination, but mostly in individuals characterized by high-NA and/or being exposed to intense stress. In those individuals, high *negative emotional reactivity* elicited by concern-related cues is expected to funnel the associative pathways of ST and to render undirected thoughts rigid and repetitive. This interpretation is supported by findings that pleasant activities brightened mood and reduced rumination in depressed individuals, presumably by interrupting their ruminative train of thought because the positive distraction overrides the existing cognitive processing priority, and this mood-brightening and rumination-reducing effect was especially marked in more highly depressed individuals (Takano, Sakamoto, & Tanno, 2013). Additionally, other features could contribute to shaping ST into depressive rumination, such as *high frequency*, *self-focus*, *abstract processing*, *past-focused temporal perspective*, and *reduced cognitive control* (Koster et al., 2011; Nolen-Hoeksema et al., 2008; Watkins, 2008).

Note that trait ST and trait rumination are by no means the same phenomenon, as correlational studies clearly report only moderate correlations (Epel et al., 2013; Marchetti, Van de Putte, & Koster, 2014). In our view, rumination is a specific subtype of ST characterized by dominant negative content that is processed in an abstract and repetitive way, locking the train of thoughts into a thematically narrow content channel (Klinger, 2013a; Smith & Alloy, 2009; Watkins, 2008),

whereas most ST unfolds in an open, expansive, and divergent way (Bar, 2009; Watkins, 2010). Moreover, rumination can be initiated intentionally (Nolen-Hoeksema et al., 2008) or be repeatedly shared with others in verbal fashion (i.e., co-rumination; Rose, Carlson, & Waller, 2007). Both these features do not characterize ST.

Several neurocognitive findings highlight specific features of undirected thought (e.g., associative narrowing, increased self-focus, abstract processing, past-focused projection, and reduced cognitive control) as key properties capable of hijacking ST toward rumination. For instance, Ottaviani, Shapiro, and Couyoumdjian (2013) reported that perseverative cognition (i.e., rumination and worry) in the context of mindwandering was characterized by increased levels of cognitive inflexibility, autonomic rigidity, and mood worsening compared to being focused either on task or non-perseverative mindwandering. Moreover, higher frequency of trait daydreaming was found to serially predict increased levels of brooding and depressive symptoms, but, importantly, via mediation by self-focus (Marchetti et al., 2014). Furthermore, although no study to our knowledge has directly investigated the interplay among processing style (abstract vs. concrete), temporal self-projection (past vs. present vs. future), and ST, research shows that ruminative thinking is usually abstract (Watkins, 2008) and past-focused (Nolen-Hoeksema et al., 2008;). Therefore, it is reasonable to argue that when ST turns out to be abstract and past-focused, such as after negative mood induction (Poerio et al., 2013; Smallwood & O'Connor, 2011), and under the influence of the individual's negative emotional reactivity, undirected thoughts could become ruminative, with consequent narrowed attention. Finally, Berman et al. (2011) reported that during resting state, the strength of functional connectivity between the subgenual cortex (SGC) and the PCC correlated with the score on brooding in both depressed and healthy individuals. Interestingly, the connectivity between SGC and PCC was stronger in depressed individuals during rest than during task engagement compared to healthy individuals.

Consistently, the reviewed studies highlight that ST *per se* is not maladaptive, but rather the precursor, under particular circumstances, of rumination. Additionally, there are also situational factors that facilitate the occurrence of the ruminative component of undirected thoughts. As the information coming from the external world is processed to a lesser extent during rest or task-unrelated thought (Barron, et al., 2011; Smallwood, Brown, et al., 2011), it follows that the chance to be distracted from the ruminative train of thoughts is reduced. Distraction has been suggested as a possible way to decrease repetitive thinking and reduce its negative effects (Nolen-Hoeksema et al., 2008; Takano et al., 2013).

In sum, we hypothesize that ST could predict concurrent and future depressive symptoms via mediation by rumination, and in particular, brooding. Importantly, we expect this mediational effect to be qualified by high levels of trait NA and/or stress, along with increased levels of self-focus, past-focus, abstract processing, and reduced cognitive control.

Hopelessness

Hopelessness is considered a proximal sufficient cause of depression (Abramson, Metalsky, & Alloy, 1989; Abramson et al., 2002), as high levels of this risk factor have been associated with both concurrent and future depressive symptoms (Alloy, Abramson, Whitehouse, & Hogan, 2006). Hopelessness is defined as “an expectation that highly desired outcomes will not occur or that highly aversive outcomes will occur coupled with an expectation that no response in one's repertoire will change the likelihood of occurrence of these outcomes” (Abramson et al., 1989, pp. 359). Although this definition suggests that the perceived likelihood of negative future scenarios is a key feature of hopelessness, only a specific type of future negative outcomes is believed to lead to depression. The nonoccurrence of desirable scenarios impacts mental functioning and mood only to the extent to which the individual is committed to reach those outcomes and thinks they are “in the realm of possibility”. This specific feature clearly mirrors the current concerns theory (Klinger, 1971; Klinger & Cox, 2011), as both theories suggest that people commit themselves to specific goals and remain

“concerned” until either reaching or abandoning them (Abramson et al., 1989). While missing a goal that is not self-central likely leads to minor consequences, abandoning important goals may be perceived as a stressful life event (Carver & Scheier, 1998).

Important to the present formulation is that specific features of ST could facilitate the occurrence of hopeless thoughts. Not only does ST center on one’s current concerns, but it also seems to preferentially focus on future scenarios (Baird et al., 2011). Therefore, in vulnerable individuals (i.e., high-NA and/or under high levels of stress), undirected thoughts could deal with gloomy or catastrophic future scenarios related to important personal concerns, and, given the occurrence of funneled ST in these individuals, alternative and more positive future scenarios are unlikely to be generated. It follows that the repetition of undesirable future events could lead to the inference that these scenarios are inescapable and beyond the individual’s control. Moreover, the focus on distant-future scenarios could hinder concrete processing and facilitate an abstract processing style (abstract temporal construal; Trope & Liberman, 2003), which along with negative content and repetitiveness has been related to depressive outcomes (Watkins, 2008).

Several findings support the hypothesis that ST may be related to gloomy/catastrophic future scenarios and related learned helplessness. First, in a recent diary study, involuntary negative future projections were specifically correlated with a type of daydreaming (i.e., guilty-dysphoric) characterized by marked negative emotional reactivity (Finnbogadóttir & Berntsen, 2013). Moreover, mindwandering focused on the distant future has been reported to be significantly more abstract than thoughts focused on the near future (Stawarczyk, Majerus, et al., 2013). Consistent with this finding, increased rest-related activity in the VMPFC has been found to be correlated with individuals’ levels of hopelessness (Grimm et al., 2008).

Second, research has associated learned helplessness and mindwandering (for a review, see Mikulincer, 1996). Learned helplessness (Seligman, 1975), later incorporated into the hopelessness theory (Abramson et al., 1989), deals with performance deficits induced by unsolvable problems.

Mikulincer (1989) reported that exposure to unsolvable problems (i.e., stress) leads to worse performance in a search task in individuals who habitually engage in mindwandering or in those who show more mindwandering after the helplessness induction.

In sum, under certain circumstances, thoughts and feelings of hopelessness seem capable of becoming the content of ST. This mainly occurs in individuals with pre-existing negative emotional reactivity to concern-related cues and/or facing stressful conditions that undermine one's feeling of control (Mikulincer, 1996). In relation to the previous section, negative ST does not always support past-focused ruminative thoughts, but it may take the form of abstract thoughts on detrimental and dismal future scenarios (Finnbogadóttir & Berntsen, 2013; Stawarczyk, Majerus, et al., 2013). Consequently, ST could predict concurrent and future depressive symptoms via mediation by hopelessness in those with high levels of NA and/or facing stressful and seemingly uncontrollable situations. Such effects emerge when ST is characterized by negative thoughts that are abstract and focused on gloomy future scenarios, along with impaired cognitive control and reduced feelings of self-efficacy.

Low Self-Esteem

Low self-esteem, defined as a negative attitude toward the self (Rosenberg, 1965), is usually considered a key cognitive feature of depression (i.e., negative self-schemata; Beck, 1967; Clark, Beck, & Alford, 1999). The evaluative component of self-esteem stems from a comparative process between the "actual self", the current self-representation, and the "ideal self", representing the characteristics that an individual aspires to have (Higgins, 1987). The assumption underlying this model is that the ideal self serves as both a motivational incentive for future behavior (i.e., a goal) and as the relevant standard for judging goal-progress. From this, it follows that individuals with low levels of self-esteem are expected to show larger actual-ideal self-discrepancy, in that the current self is far removed from the desired self. Consistent with this, research shows that dysphoric individuals report a large self-discrepancy (Moretti & Higgins, 1999).

In our framework, the comparative process addressing self-esteem is actively processed during ST with the ideal self representing a higher-order goal to which individuals are powerfully committed in their undirected thoughts. In keeping with this, previous literature shows that high-NA individuals usually dwell upon and magnify previous mistakes and disappointments, which, in turn, leads to concurrent low self-esteem (Watson & Clark, 1984). Given the focus on the self (Song & Wang, 2012), undirected thoughts increase the chances for high-NA individuals to address their self-related discrepancy and view their actual self as negative and unworthy. From this hypothesis, it follows that the larger and more negative the actual-ideal self-discrepancy is, the more pressing, more repetitive, and probably more abstract ST becomes.

The link between ST and self-esteem has not gone unnoticed. In his pioneering work, Rosenberg (1965) reported that in a sample of about 3000 adolescents, only 13% of individuals with high self-esteem defined themselves as frequently engaged in daydreaming. In contrast, 60% of individuals with low self-esteem reported being habitual daydreamers. Importantly, larger actual-ideal self-discrepancy has been associated with guilty-dysphoric daydream tendency (Klinger, Henning, & Janssen, 2009). Moreover, it has been suggested that abstract processing in individuals at risk for depression could promote the persistence of overgeneralized negative self-views and hinder the processing of positive elements (Vess, Arndt, & Schlegel, 2011). Finally, at the neurocognitive level, Disner et al. (2011) proposed that, among other areas, the MPFC plays an important role in supporting negative self-schemata. In keeping with this, Frewen, Lundberg, Brimson-Théberge, and Théberge (2013) reported that the VMPFC is specifically associated with negative self-esteem in women.

In sum, the reviewed literature suggests that during ST people actively address self-discrepancy. In individuals who are temporarily or stably at risk for depression, ST could strengthen and amplify negative self-esteem. Our model suggests that ST could predict both current and future depressive symptoms via the contribution of low self-esteem. Complementary to this hypothesis,

we anticipate that self-centered but self-deprecating, negatively valenced, and abstract ST could predict depressive symptoms synchronously and over time.

Cognitive Reactivity

Cognitive schema theory has been one of the dominant models of depression during the last forty years (Beck, 1967). This theory proposes that information processing is guided by individuals' schemata, conceived as cognitive representations about the self, the world, and the future, that are thought to impact mental functioning only if activated by relevant stimuli (Clark et al., 1999). This vulnerability-stress perspective, addressed under the notion of cognitive reactivity, refers to tightening of the associative network between the self, negative thinking, and negative mood following depressive episodes (Teasdale, 1988). The term cognitive reactivity represents the fluctuations of negative self-attitudes in reaction to stressors, even if these are mild (Butler, Hokanson, & Flynn, 1994). From the theory, it follows that activation of any element of the network will putatively activate the network itself. Accordingly, priming negative mood has been shown to trigger negative schemata (for a review see Scher, Ingram, & Segal, 2005). Importantly, inducing self-focus also has been found to activate negative schemata (Hedlund & Rude, 1995), and mood-induced cognitive reactivity may predict relapse in remitted depressed individuals over 18 months (Segal et al., 2006; but see van Rijsbergen et al., 2013).

How is cognitive reactivity linked to ST? We propose that in individuals characterized by high NA and/or intense stress, the narrowing of the associative network of ST (i.e., *funneling effect*) could facilitate cognitive reactivity. Highly frequent experience of ST segments in which self-related information co-occurs with negative thoughts and negative mood could facilitate the linkage among these pieces of information and the creation of a stable associative network in memory.

Some preliminary evidence supports this hypothesis. First, manipulations involving either negative mood or self-focus can trigger mindwandering (Smallwood et al., 2009; Smallwood, Schooler, et al., 2011) and, within this, the emergence of negative cognitions (Hedlund & Rude,

1995; Scher et al., 2005). Second, stress-related NA has been reported to predict subsequent increased use of self-blaming negative words conveying a negative view about the self or the future (i.e., cognitive reactivity), during a task of free writing (Crystal, Simonson, Mezulis, & Pegram, 2012). Third, in the context of daydreaming, higher levels of internal focus during rest have been shown to predict increased levels of state rumination and negative mood in individuals with medium or high levels of trait cognitive reactivity (Marchetti et al., 2013). Fourth, a theoretical proposal has directly linked the DMN with cognitive reactivity (Marchetti, Koster, Sonuga-Barke, et al., 2012). Confirming this association, Zamoscik, Ebner-Priemer, Huffziger, Kirsch, and Kuehner (2014) documented that individuals characterized by high levels of cognitive reactivity (i.e. remitted depressed individuals) displayed increased functional connectivity between the PCC and the parahippocampal gyrus during recall of a negative autobiographical memory compared with healthy controls. The increased connectivity predicted increased ruminative thinking during daily life.

In sum, ST and cognitive reactivity share many theoretical and empirical similarities, such as relying on associative processing and being sensitive to negative mood and self-focus, aspects that render the understanding of their reciprocal relationship worth highlighting. To fill this gap, the present formulation suggests that, under certain circumstances (i.e., high NA and/or intense stress), ST could act as a precursor for the occurrence of cognitive reactivity, which, in turn, could explain concurrent and future depressive symptoms.

Mindfulness

Mindfulness is considered a powerful protective factor against depression (Ma & Teasdale, 2004). Despite the lack of agreement about its definition (Grossman & Van Dam, 2011), two key features of mindfulness are (i) sustained attentiveness to the present moment, and (ii) a receptive and non-judgmental attitude toward inner experience. Considering the features of ST, the relationship between undirected thought and mindfulness is worth examining.

First, ST *per se* implies by definition a mental drift from the here-and-now, reducing awareness of the surrounding environment (Smallwood & Schooler, 2006). Thus, it seems reasonable to hypothesize that ST and mindfulness represent divergent constructs, although not fully opposite as both rely on self-awareness to a certain extent. In fact, research showed that mindful observing of inner experience is positively correlated with self-awareness (Evans, Baer, & Segerstrom, 2009). Second, daydreaming and mindfulness imply that the individual frequently attends to his/her own inner experience, but the relative attitude toward mental events seems crucial in leading to either positive or negative consequences. While in individuals with high NA and/or intense stress, ST is characterized by frequent repetitive self-criticism, abstract processing, and negative mood, all these characteristics are absent, if not reversed (e.g., acceptance, concrete processing, and positive mood), in mindful individuals.

Evidence deriving from questionnaire, experimental, and neuroimaging studies confirms that ST and mindfulness are negatively related. First, Mrazek et al. (2012) reported that multiple markers of mindwandering during the SART and trait tendency to engage in daydreaming were all moderately negatively correlated with dispositional mindfulness. These findings have been replicated by several researchers (e.g., Deng et al., 2012; Marchetti et al., 2014; Stawarczyk et al., 2012). Second, it has been documented that, in mindful individuals, the content of their ST is characterized by concrete processing, decreased personal significance, and positive valence, whereas these characteristics are reversed in individuals with high levels of rumination and “NA/depression” (Andrews-Hanna et al., 2013). Third, increased resting state activity in the MPFC and PCC is reportedly negatively correlated with individuals’ levels of dispositional mindfulness (Way, Creswell, Eisenberger, & Lieberman, 2010).

In sum, findings confirm that trait high ST and mindfulness are contrasting constructs, with higher levels of undirected thoughts implying lower levels of mindfulness and vice versa. Nevertheless these two phenomena are not fully opposite as they are negatively correlated with only

small to moderate magnitude. This modest link could be accounted for by the fact that both phenomena seem to partially rely on the same functions, such as self-awareness (Evans et al., 2009). However, whereas mindful awareness is characterized by a non-judgmental attitude toward the self, ST in at-risk individuals is likely to stimulate a detrimental tendency to process self-salient goal discrepancies, repetitively and abstractly, along with reduced ability to stop any downward spiral. Future research should clarify the exact relation between different types of ST (and not only its frequency), and mindfulness.

Retrospective and prospective studies on spontaneous thought

Despite the abundance of cross-sectional studies on the role of ST, the correlational nature of the data does not allow any strong conclusions regarding the role of undirected thoughts as a condition preceding persistent negative thought and, in turn, depressive symptoms later in life. Hence, it is important to examine both retrospective and prospective studies to clarify the temporal relation between ST and detrimental outcomes.

With respect to the retrospective studies, Tarter, McBride, Buonpane, and Schneider (1977) retrospectively compared the types of childhood characteristics reported by predominantly depressed psychiatric patients, alcoholics, and healthy controls. Interestingly, half of the psychiatric patients (51%) reported having been “daydreamers” during their childhood, with an impressive peak for severe alcoholics (78%), compared to healthy controls (22%). A similar trajectory has been shown by studies on daydreaming as an immature involuntary coping strategy (Vaillant, 2011).

Although in a preliminary way, a handful of longitudinal studies have examined the important role of ST in accounting for detrimental mental and physical trajectories in at-risk individuals (e.g., Akiskal et al., 1995; Jensen, 1987). Crucially, Feldman and Hayes (2005) and Oettingen (2012) have provided evidence regarding the maladaptive role of coping with stressful situations by immersing oneself in daydreams about the desired outcomes and ignoring the necessary steps to accomplish them. Engaging in this type of spontaneous thought predicted

depressive symptoms after thirteen weeks in an at-risk population, even after controlling for depressive symptoms at the baseline (Feldman & Hayes, 2005).

Spontaneous Thought and Bipolar Disorder

Bipolar disorder (BD) is a severe mental illness characterized by recurrent episodes of depression and (hypo)mania (Goodwin & Jamison, 2007). Interestingly, BD and mania have been associated with highly ambitious, or even unrealistic, goals along with an increased engagement in goal-striving (Alloy, Urosevic, et al. 2012) and enhanced sensitivity to life events related to goal-achievement (Nusslock, Abramson, Harmon-Jones, Alloy, & Hogan, 2007). Therefore, it is possible to suggest that a similar funneling dynamic of ST as the one described in individuals at risk for depression could occur also in those characterized by excessive motivation to achieve goals that are hard (if not impossible) to reach. In individuals at risk for mania, the commitment to such ambitious (or even unrealistic) goals might result in strong current concerns whose pursuit is actively sustained by excessive goal-striving and mentally represented in ST. Besides, such powerful motivation prevents these individuals from disengaging from and abandoning their unrealistic goals, thus leading to a narrowing of their wandering thoughts. This briefly sketched dynamic might, in individuals at risk for BD, account for a similar funneling effect as the one described in those at risk for unipolar depression.

Although understudied, the relationship between ST and mania is supported by early and recent studies. For instance, Smith (1933) showed that 11 out of 26 BD patients reported daydreaming frequently and 17 of them claimed that the topic of their daydreams was about improbable events. More recently, an 11-year longitudinal study investigated a large sample of 559 unipolar depressed individuals who later developed bipolar disorder (Akiskal et al., 1995). In that study, the tendency to engage in ST by unipolar patients predicted those who later developed a manifest bipolar disorder. Finally, a study of a non-clinical sample documented that higher levels of habitual daydreaming were predicted by higher risk for bipolar disorder (Meyer et al., 2011).

We propose that, in individuals at risk for mania, ST may trigger and, perhaps, contribute to maintaining manic phases. More specifically, we expect this effect in individuals characterized by relentless goal-striving, whose undirected thoughts are frequent, highly self-centered, and envisioning grandiose success related to unrealistic goals.

Discussion

ST is a complex cognitive phenomenon that serves essential functions in goal pursuit during periods of low or no engagement in external tasks (Klinger, 1971, 2009), and it helps in maintaining plans for non-immediate goals (Klinger, 2013a). Nevertheless, the very same mechanism also may be associated with undesirable side-effects (Klinger, 1996a; Watkins, 2008). Based on the extant literature, including questionnaire, behavioral, and neuroimaging studies, we propose a possible mechanism whereby ST can act as a precursor of major cognitive risk factors that, in turn, could account for both concurrent and future depressive episodes (Figure 1).

Given its intrinsic features, ST is proposed to be a phenomenon capable of amplifying cognitive risk factors for mood disorders (*amplification hypothesis*), but mostly in individuals characterized by trait *negative affectivity* (Andrews-Hanna et al., 2013; Watson & Clark, 1984; Zhiyan & Singer, 1996-1997) and/or exposed to intense *stress* (Klinger et al., 1980; Stawarczyk et al., 2013). In these vulnerable individuals, we argue, ST may lose its open, expansive, and recreational nature, and may become rigid, inflexible, and funneled into fewer topics (*funneling effect*; Bar, 2009; Clore & Gasper, 2000; Watkins, 2010). Along with this mental pruning, additional changes are expected to occur regarding the content and the process of ST, such as increased frequency, abstract processing, and markedly negative content with reduced capability of manipulating it. From this, it follows that, due to these undesirable effects, ST (and the underlying continuous goal-discrepancy) is theorized to boost four major risk factors, namely *rumination*, *hopelessness*, *low self-esteem*, and *cognitive reactivity*, and, subsequently, lead to concurrent and future depressive symptoms (Feldman & Hayes, 2005; Giambra & Traynor, 1978).

It is important here to mention that, although these vulnerability factors share many features, they are by no means all the same (e.g., past-focused rumination vs. future-focused hopelessness). This highlights the need for our model to specify which risk factor(s) ST is expected to boost at the individual level. By relying on previous literature (Bigelsen & Schupak, 2011; Klinger, 1971; Harmelech & Malach, 2013; Varendonck, 1921), we propose that ST (and the underlying neurobiological substrate) recapitulates and maintains the behavioral, cognitive, and emotional repertoire of the individual, so that the cognitive risk factor to which the individual is most susceptible will be the most likely to be amplified by ST. Importantly, this suggested susceptibility is to be understood within a biopsychosocial context including genetic, neurobiological, psychological, and environmental influences.

Finally, we showed evidence that high levels of (negatively funneled) ST accompany reduced mindful attention to the present, a mental attitude shown to protect against psychopathology (Ma & Teasdale, 2004). Additionally, the model suggests a tentative mechanism whereby ST could facilitate the occurrence of manic phases via the perpetuation of unlikely/unrealistic and grandiose goals to which at-risk individuals are excessively committed (Alloy & Abramson, 2010).

The above formulation raises some important theoretical issues. First, preliminary evidence suggests that *excessive* ST, regardless of its valence, leads to significant levels of personal distress (Schupak & Rosenthal, 2009). Importantly, Bigelsen and Schupak (2011) carried out a qualitative/quantitative study on 90 self-identified excessive daydreamers, the vast majority (88%) of whom reported significant levels of distress and/or impairment due to ST. On the one hand, these individuals reported difficulty in limiting their engagement in ST and, despite the valence of their STs, this led those who suffered the most from this condition to seek professional help. On the other hand, 71% of these individuals perceived themselves as significantly more creative than others. Therefore, we suggest that not only does excessively frequent ST facilitate adaptive functions, such as creativity and empathy, but it also inherently, as our model has highlighted for susceptible

individuals, increases maladaptive consequences. In sum, insofar as undirected thoughts may support maladaptive adjustment, excessive ST appears worthy of clinical attention.

Second, our model is directionally oriented, starting with ST and leading to increased depressive symptoms via multiple mediation of different cognitive risk factors. Such directionality is to be understood as a simplification for the sake of clarity, in that the presence of depressive symptomatology is likely to enhance and strengthen the negative emotional reactivity that we propose to be the key mechanism associated with undesirable outcomes (Andrews-Hanna et al., 2013; Marchetti et al., 2012; Meyer et al., 2011). By establishing such positive feedback loops between depressive symptoms and concern-related negative emotional reactivity, ST is expected to perpetuate a downward spiral paving the way to severe consequences for mental well-being, such as major depression.

Clinical Implications

The proposed theoretical framework of ST and its role in mood disorders points toward a number of clinical implications. The primary therapeutic goal should be to target maladaptive aspects of ST. Therefore, first, a key mechanism that should be the target of clinical attention is negative emotional reactivity elicited by the processing of concern-related cues that lead to a narrowing of undirected thought. Negative affectivity, which we propose to be a main factor implicated in maladaptive outcomes for ST, is considered a stable and heritable trait (Tellegen et al., 1988; Watson & Clark, 1984). Nevertheless, preliminary but promising interventions for decreasing negative affectivity/neuroticism have recently been reported, ranging from physical activity to tailored psychotherapeutic protocols (for an excellent review, see Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014). For instance, the unified protocol for the transdiagnostic treatment of emotional disorders has been proven to specifically target maladaptive temperamental affectivity, namely enhanced negative affectivity and reduced positive affectivity (Barlow et al., 2014). This

treatment consists of increasing present-focused emotional experience, increasing cognitive flexibility, inhibiting avoidance of inner experiences (e.g., thoughts, feelings, physiological events, and memories), improving awareness and tolerance for emotion-related physical sensations, and exposure to interoceptive and context-based emotions. Importantly, Farchione and colleagues (2012) demonstrated in a randomized controlled trial the efficacy of this intervention with moderate to large effect on affect-related measures. Finally, mindfulness-based cognitive therapy (Ma & Teasdale, 2004) and acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 1999) could be options to precisely mitigate self-criticism during ST, and specific trainings are available to target individual processing style, moving from abstract to more concrete (Watkins et al., 2012).

Second, important for the proposed model is the daydreamer's motivational structure leading either to positive or negative outcomes. Longing for unrealistic, overvalued, unreachable goals or being reluctant to relinquish them (once failed) are both likely to cause mental distress and should, in turn, be targeted by clinical interventions. In this regard, Cox and Klinger (2011c) have developed a specific type of counseling aiming to reduce commitment to unrealistic and self-destructive goals and to redirect the person toward more realistic and adaptive goals. This intervention begins with a rigorous assessment of client's motivational structure, for instance by means of the Motivational Structure Questionnaire (Cox & Klinger, 2011b), followed by the identification of goal interrelationships along with the disengagement from (i.e., re-negotiation of) maladaptive goals and re-engagement with more adaptive ones (for a detailed description of specific clinical group techniques, see also Fuhrmann, Schroer, de Jong-Meyer, 2011). Importantly, recent evidence supports the view that adaptive self-regulation of unattainable goals positively impacts subjective well-being (Wrosch, Scheier, Miller, Schulz, & Carver, 2003), a finding confirmed by the clinical efficacy of motivational counseling in alcoholic patients (Cox, Fardari, Hosier, & Pothos, in press). Therefore, the use of motivation-focused interventions would appear to reduce maladaptive ST.

Third, although ST is a frequently occurring feature of normal human thought (Killingsworth & Gilbert, 2010; Klinger & Cox, 1987-1988), reports of excessively frequent undirected thought along with maladaptive consequences have recently been documented (i.e., Bigelsen & Schupak, 2011). In this specific context, we believe that the target of clinical attention should be not only the content of ST and the emotional reaction to it, along with the underlying motivational structure, but also the extent of undirected thought with the specific aim to reduce it. To do so, different options are available. For instance, mindfulness trainings appear to be a viable and cost-benefit balanced type of intervention (Mrazek et al., 2012). Finally, it is reasonable to speculate that motivation-focused clinical interventions, such as systematic motivational counseling (Cox & Klinger, 2011c), could effectively increase emotional satisfaction with attaining real-world goals and reducing anxieties and other threat-related negative emotions associated for the client with real-world goal pursuit. This would render reality more appealing than fantasy and could help the individual disengage from gratifying imaginary scenarios.

Limitations

Notwithstanding the consistency of the reviewed literature, we acknowledge several limitations that should be the focus of further investigation. First, ST, as current theorists conceptualize it (Christoff, 2012; Klinger, 2009; Smallwood & Schooler, 2015), consists of different phenomena that are moderately correlated and partially covarying across different methods of measurement. On the one hand, this raises the question regarding to what extent each of these constructs captures specific aspects undetected by the others. On the other hand, ST is a type of stream of consciousness that is intrinsically characterized and enriched by its multifacetedness (as is task-related thinking); therefore, any approach that considered only certain modes of thinking or privileged a particular method would jeopardize our understanding of such a complex phenomenon. To avoid this, the current review took into account the most frequent types of spontaneous thought,

which occur and interchange with one another in everyday life (Pope, 1977, as cited in Klinger, 2013a) and are all rooted in the same neurobiological substrate (Mason et al., 2007; Christoff et al., 2009). Moreover, a multi-method approach has explicitly been adopted, where self-report, neurophysiological, and behavioral measures are combined, as current guidelines suggest (triangulation; Smallwood & Schooler, 2015). By doing so, the construct of ST, as we operationalized it, has the benefit of critically enhancing the ecological and clinical validity of our model.

Second, it is also possible that the relationship between ST and vulnerability to mood disorder could be primarily bidirectional or influenced by a third factor, such as previous depressive episodes. On the one hand, although daydreaming frequency has been reported to be correlated with the number of previous depressive episodes (Meyer et al., 2011), it is highly unlikely that the pervasive nature of ST is *in toto* attributable to a sort of “scar” effect. Multiple studies on the frequency of daydreaming across the life span show that this phenomenon reaches its peak in late adolescence (Giambra, 2000), a period during which it is rare to have had multiple depressive episodes. Therefore, considering its developmental unfolding, ST could hardly be considered as a side effect of previous mental disorders, rather than as a genuine and constitutive mechanism of the human mind, firmly based in a neural network present since birth (Gao et al., 2009). On the other hand, although studies associating ST and cognitive risk factors for depression (and bipolar disorder) are mostly correlational, preliminary longitudinal evidence suggests that daydreaming about desired outcomes in the context of stress could predict future depressive symptoms in an at-risk population (Feldman & Hayes, 2005) and that daydreaming frequency could account for the conversion from unipolar to bipolar disorder (Akiskal et al., 1995). Although far from being conclusive, these preliminary pieces of evidence support the view that some properties of ST represent valuable predictors of future maladjustment in at-risk individuals.

Future research

We believe that our framework paves the way for several kinds of future studies. First, a powerful method to test our longitudinal predictions is the behavioral high-risk design (Alloy et al., 2006). This specific longitudinal design entails recruiting individuals who do not show significant levels of the criterion of interest (e.g., depression) and show either high or low levels of a “vulnerability factor” (e.g., high ST plus negative emotional reactivity and/or guilty-dysphoric style of daydreaming). By doing so, the hypothesized influence of ST and cognitive vulnerability on depressive symptoms could be evaluated by means of multiple assessments across time.

Second, we believe that clinical psychological science would benefit from a more systematic integration of its corpus of knowledge with current perspectives on motivation and goals. In fact, it has been documented that individuals’ goals exert a powerful influence on a vast range of mental functions, such as, among others, attention, memory, emotions, and action (Gray, 1994; Nikula et al., 1993). Notwithstanding this convincing evidence, there have been only scarce attempts to relate psychopathological conditions (with the exception of alcoholism and substance abuse disorder; Cox & Klinger, 2011a) to specific patterns of current concerns, difficulty of disengaging from dysfunctional goals and lack of re-engagement into more positive ones (Wrosch et al., 2003). In ST research, as in psychopathology more generally, incorporating knowledge of psychobiological motivational systems and motivational structures would be highly interesting.

Third, although ST is known to be a phenomenon unfolding over time and over different timescales (e.g., seconds, hours, days, etc.), very few attempts have been made to specifically investigate its temporal dynamics. The real-time progression of different ST segments or the interplay between STs and task-related thoughts in everyday life remains so far to a large extent unknown. In fact, most experience-sampling studies carried out have capitalized on indexes of central tendency (i.e., mean) rather than focusing on indexes of variability and (un)predictability (e.g., entropy). In contrast, our model posits that ST is a mental event that unfolds over time in a rather complex way, with individuals’ current concerns dictating the content and the

frequency/extent of their (spontaneous) mental activity. Such a perspective formally parallels the Dynamic System Theory (Thelen & Smith, 1996), within which nonlinear dynamics can be operationalized mathematically (e.g., attractors, repulsors, bifurcations, etc.). This approach seems to be particularly attractive in clinical research where the interplay of different types of maladaptive spontaneous thoughts is to a large extent under-investigated (for an exception see, Koster et al., 2015).

Fourth, although positively valenced ST (i.e., positive-constructive daydreaming style) was not the main focus of this article, its role in mental health is worthy of future studies. This specific daydreaming style is considered quintessentially adaptive (McMillan et al., 2013), but its relationship with depressive symptoms appears mixed (Golding & Singer, 1983; Segal & Lynn, 1992-1993). Taken together, these findings suggest that indulging in positive ST can, under certain circumstances, enhance the likelihood of developing mental distress, such as when positive fantasies are unrealistic and characterized by low expectations of reaching the fantasized goal (Oettingen, 2012). Hence, more thorough investigation of the clinical impact of positive daydreaming is warranted.

Conclusion

ST is considered the mental state from which we depart to engage in activity and to which we return after completing or abandoning a task. During this period of inattentiveness for any task or the surrounding environment, the mind is far from just calmly resting. Relying on empirical data and previous theories, we propose that, while freely wandering, the mind actively processes unattained personal goals toward which the daydreamer is powerfully committed. Although this mechanism provides clear advantages in terms of enhanced likelihood of reaching important goals, ST may also perpetuate maladaptive consequences, when undirected thoughts go through a process of narrowed focus that accompanies steering of undirected thought toward markedly negative

valence, enhanced self-focus, unusually high frequency, and abstract processing. In this context, ST operates as a potential precursor of maladjustment and reduced subjective well-being.

By reviewing extensive literature, we have highlighted what we could term the “dark side” of ST. Many findings indeed report that well-known mechanisms leading to depression, such as rumination, hopelessness, low self-esteem, and cognitive reactivity, are consistently associated with daydreaming and are likely to exacerbate negative mood in individuals. In conclusion, although consistent findings highlight its fruitful role, ST is not immune from less positive side-effects in individuals already vulnerable to mood disorders. Hence, we argue for considering ST as an important factor for both research and clinical practice.

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Notes

¹ : We here term the variable A “precursor” of the variable B, when the variable A exerts influence over the outcome O, via the mediation of a third variable B. This relation is qualified by “temporal precedence (with A preceding B), correlation between A and B, and when one considered A and B jointly, either domination of A by B (total mediation) or codomination by A and B (partial mediation)” (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001; p. 852).

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Table 1. Phenomenology of daydreaming and daydreaming-related phenomena

<i>Phenomenon</i>	<i>Definition</i>	<i>Assessment</i>
Spontaneous thought	“Unintended, nonworking, noninstrumental mental content that comes to mind unbidden and effortlessly” (Christoff, 2012, p. 52; Klinger, 2009). Overarching type of self-generated thought, including <i>mindwandering, involuntary autobiographical memory, and daydreaming.</i>	It may occur during either task-pursuit or resting states. Behavioral and self-report questionnaire assessment
Mindwandering	“Shift of attention away from a primary task toward internal information” (Smallwood & Schooler, 2006, p. 946). It encompasses task-unrelated thoughts (otherwise known as off-task thoughts) during task engagement	It occurs during task-pursuit. Self-report, behavioral, and neurophysiological markers (Smallwood & Schooler, 2006)
Task-unrelated thought or off-task thought	Inward thoughts not related to the task at hand. Mindwandering, task-unrelated thought, and off-task thought are to be considered as synonyms. Their direct opposite is on-task thought, intended as a thought concerning the ongoing task	Thought probing during task-pursuit or after-task questionnaire (Smallwood & Schooler, 2006; Stawarczyk et al., 2011)
Involuntary autobiographical memories	Personal memories that arise spontaneously without any attempt to intentionally retrieve them (Berntsen, 2009)	Diary studies (Berntsen, 2009) and experimental assessment, such as vigilance tasks (Vannucci et al., 2014)
Daydreaming	“a shift of attention away from an ongoing physical or mental task or from a perceptual response to external stimulation toward some internal stimulus” (Singer, 1966, p. 3). Daydreaming defines spontaneous thoughts that are characterized by a marked imaginative nature.	It occurs especially during resting state. Experimental assessment (Marchetti et al. 2013), self-report questionnaires (Huba et al., 1981), and experience sampling studies (Klinger & Cox, 1987/88).
Self-generated thought	Process whereby “ <i>contents of experience arise from intrinsic changes that occur within an individual rather than extrinsic changes that are cued directly from perceptual events occurring in the external environment</i> ” (Smallwood, 2015, p. 3)	/
Undirected thought	Thoughts not deliberately directed by the individual. “ <i>Its direction may be implicitly biased or influenced by the thinker’s current concerns or emotional states</i> ” (Christoff, 2012, p. 52). It is here intended as interchangeable with spontaneous thought	See Spontaneous thought

Figure 1. Theoretical framework – spontaneous thought and cognitive risk factors for depression

