GOALS AND FUNCTIONS OF RUMINATION: A REVIEW[1]

Roberta Trincas, Chiara Schepisi, Estelle Leombruni, Valentina Emilia Di Mauro, Francesco Mancini

Abstract

Rumination, defined as a habitual and repetitive thinking style that revolves around a specific theme, has been involved in the development and maintenance of severe psychopathologies. Despite such a critical role in psychopatology, goals and functions of rumination have not yet been unravelled. The rationale behind investigating goals of rumination relies on the evidence that repetitive thinking may be adaptive and indeed, rumination is a common thinking process in a non-clinical population.

Within this frame, the overall aim of this study is to build an exhaustive model of rumination based on Carver and Sheier's goals-driven behaviour self-regulation theory (2004, 2011).

To reach this aim, we revised the most relevant theoretical models and experimental evidence on rumination in order to identify potential indicators of the role of rumination within the individual's goal system.

Based on current evidence, the function of ruminative thinking is to focus on those events that may interfere with goal achievement (or goal avoidance) in order to facilitate progression toward relevant goals. In particular, rumination seems to serve goals at an intermediate level in the goal hierarchy. Hence, by repeatedly focusing on an event, physical sensation or feeling which is related to an unachieved goal, the individual tries to overcome the block in order to reach the ultimate goal of the desired self.

Key words: rumination, goals, function, repetitive thinking

Roberta Trincas*, Chiara Schepisi*, Estelle Leombruni*, Valentina Emilia Di Mauro*, Francesco Mancini*°
* Scuola di Psicoterapia Cognitiva, Rome Italy
° Marconi University, Rome, Italy

Corresponding author
Roberta Trincas
Email: trincas.roberta@gmail.com
Permanent address: Associazione di Psicologia Cognitiva, Viale Castro Pretorio 116, 00185 Roma, Italy

1. Introduction

Rumination is a repetitive and habitual thinking process revolving around a specific theme (mostly focused on the self or on the world), even in the absence of environmental needs (Martin and Tesser 1996 Segerstrom et al. 2003).

Rumination is a transdiagnostic process, as it is present across individuals and psychopathologies. From a functional perspective, rumination may be either adaptive, when ruminative thoughts are concrete and oriented toward problem solving, or maladaptive when thoughts are abstract, repetitive and prevent the individual from problem solving (Watkins 2008).

Many studies suggest that rumination is a maintaining factor of psychopathology (Watkins 2008). Although research has addressed the issue of which functions rumination serves and why people perseverate on rumination despite negative consequences (mood deflection, anxiety and depression), distinction between functions and goals of rumination is yet unclear. Some authors suggest that rumination is aimed at emotion regulation in condition of stress while others propose that it develops as a strategy to achieve paper goals.

Within this frame, the overall aim of this study is to review theoretical models and research on rumination in order to identify functions of rumination, and to build an exhaustive model of rumination based on Carver and Sheier's goals-driven behaviour self-regulation theory (Carver and Sheier 2011).

1.1. Functions of rumination

So far, four thinking processes have been described in the literature: i) rumination, which consists in passively and repeatedly focusing on the symptoms of suffering and on the conditions that generate suffering (Nolen-Hoeksema et al. 1997, Conway et al. 2000); ii) worry: unrestrainable thoughts and images that are aimed at solving problems when outcomes are uncertain or possibly negative (Borkovec et al. 1983); iii) cognitive elaboration: thinking about a stressful event, about the sensations related to it and about the present and future implications of that event (Bower et

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al. 1998, Greenberg 1995); iv) problem solving: mental simulation of actions and future situations aimed at finding solutions to a problem (Taylor et al. 1998).

A key aspect that has heavily influenced research in the last decades is the distinction between rumination and worry. The term "worry" describes intrusive and repetitive thoughts concerning potential future threats. Conversely, rumination consists in a negative interpretation of past events. Hence, although a distinction exists, the idea that both rumination and worry share the same kind of repetitive and aimless thinking process is now widely accepted (Watkins 2016). On the other hand, the temporal focus is different: while the content of rumination refers to past events, worry is a response to future problems (Clark and De Silva 1985, Clark and Hemsley 1985).

Another feature of rumination concerns the focus of repetitive thinking. Indeed, ruminative thoughts may be focused on emotional states, as sadness or anxiety, and on physical symptoms that develop in response to stressful life events (Nolen-Hoeksema 1991, Conway Csank et al. 2000, Alloy et al. 2000, Robinson and Alloy 2003). According to some authors, in these cases, ruminative thoughts concern mood antecedents, they are not goal directed, not socially shared and do not motivate to solve the problem. In other cases, ruminative thoughts concern desired objectives and results, outcomes of adverse situations, failures, to-be-achieved or blocked goals (Martin and Tesser 1989).

The above-mentioned examples describe some key functions of rumination: mental state processing, self-knowledge, attribution of meaning to internal states and reactions, behavioral self-regulation, pursuit of relevant goals (Trapnell and Campbell 1999, Kross et al. 2005, Janoff-Bulman 2006).

The interest toward functions of rumination arises from two main findings: i) rumination has a negative impact on the individual's life; ii) repetitive thinking develops in non-clinical populations (Lyubomirsky et al. 2003, Watkins 2016). As far as negative effects of rumination are concerned, mood deflection, decision making and problem solving impairments, interpersonal difficulties have been observed. Moreover, ruminative thinking maintains or even worsens psychopathology (Davis and Nolen-Hoeksema 2000). Particularly, negative effects of rumination have been demonstrated in depressed and dysphoric patients. Indeed, rumination in dysphoric patients is associated with reduced problem solving abilities, pessimism, lack of cognitive flexibility and worst performances at school and at work (Davis and Nolen-Hoeksema 2000; Lyubomirsky and Nolen Hoeksema 1995, 1998, 1999, 2003).

Despite being associated with severe consequences, rumination is a common mental attitude. This evidence raises the question of why people ruminate. Some authors have suggested that rumination may be functional to find solutions and ameliorate life condition through self-reflection and problem-focused thinking (Ciarocco et al. 2010). Consistent with this hypothesis, several studies demonstrated the usefulness of repetitive styles of thinking, such as problem solving. However, the finding of rumination-induced impairments indicates that, when used in excess, adaptive responses may turn into dysfunctional attitudes (Seligman 1993).

Regarding the association between rumination and goals, Martin and Tesser (1998) were the first to investigate rumination within the goal system. In their "goal progress theory", these authors showed that rumination develops when a desired goal cannot be attained.

In this perspective, rumination is triggered when relevant goals are involved, which is consistent with the rules of Carver and Scheier's behavioral self-regulation theory (Carver and Scheier 2004).

As this review analyzes rumination within the frame of Carver and Scheier's model, in the following paragraph we will briefly introduce the model and the concept of goal.

1.2. The notion of goal and the mechanisms behind goal achievement

As the focus of this review is to shed light on the role of rumination within the individual's goal system, we must accurately define the construct of "goal" and goal-related processes. In their pivotal work "On the self-regulation of Behavior", Charles Carver and Michael Scheier (2011) addressed the complex relationship between goals and behavior by introducing the idea that human behavior is regulated by feedback processes aimed at maximizing goal achievement. The authors postulate that action (from basic motor sequences to complex behaviors) is triggered by the need to solve a discrepancy between the "current condition" and a "desired condition". By performing a behavior, the individual works to fill the distance between these two conditions, thus engaging in a discrepancy-reducing feedback loop. If the desired condition is a goal, then the process of discrepancy reduction brings to goal attainment. Hence, goal may be considered as the reference for behavioral self-regulatory processes, which are initiated when discrepancy is detected. If my goal is having a job (reference) but I am unemployed (current status), I will engage in behaviors that are specifically focused on getting a job (discrepancy reduction) until I reach the goal (no discrepancy).

As goals differ in value, they are organized in a hierarchy where abstract goals (i.e. being a good student) are on the top, while concrete goals (i.e. obtaining good grades at school) are at a lower level. Abstract goals have the highest value in the goal system as they are fundamental for the definition of the self, whereas concrete goals are endpoints of the process of abstract goal attainment. Abstract or higher order goals may be attained by achieving different lower order concrete goals (i.e. I can be a good student either by obtaining good grades or by arriving at school in time) and conversely each concrete goal may serve more than one higher order goal (i.e. obtaining good grades serves both being a good student and being considered as a smart person).

Understanding an individual's goal hierarchy is essential when it comes to evaluate behavioral loops. Indeed, the most valuable is the goal that should be reached through a given action or behavior, the most critical is progression toward that goal. Similarly, if performing a given action or behavior would take the individual close to goal attainment, then progression in that action or behavior would be overriding.

Within this frame, Carver and Scheier identified a second feedback loop, the affect loop, whose input is the rate of progression toward the goal. In other words, when the above-described behavioral self-regulatory process is slower or faster than expected, the affect feedback activates. Positive and negative feelings are the output signals of this feedback mechanism, and the onset of such feelings indicates that the discrepancy-reducing strategy is not working properly. The activation of the affect feedback has several implications in establishing goal priority. Indeed, when the self-regulatory process is slower than expected,

negative feelings develop, indicating that either more effort is needed to achieve the goal, or that the goal is unreachable and goal priority must be revised. On the other hand, when the self-regulatory process is faster than expected, and a small effort has yet to be spent in order to reach the goal, positive feelings inform that the individual may switch to other goals and opportunities, and help avoiding needless effort.

Overall, goals are dynamic entities that temporarily engage the mind and drive behavior. Goal hierarchy informs on the subjective value of goals and guides effort allocation to self-regulatory processes. Affect enhances flexibility by modulating goal prioritization and avoid persistence on unreachable goals.

2. Functions of rumination within basic models

2.1. Ruminating to understand problems (Nolen-Hoeksema)

Nolen-Hoeksema (1991) was a pioneer in theoretical and empirical investigation on rumination. In her Response Style Theory of rumination, the author suggests that rumination is a cognitive strategy aimed at reducing depression and negative feelings. However, hyperfocalization on negative feelings would maintain pessimistic thinking, thus preventing from problem solving and demotivating the individual to find alternative solutions. Accordingly, many studies found that rumination activated by mood deflection, compared with distraction, further maintains depression (Nolen-Hoeksema et al. 1993). Moreover, longitudinal studies demonstrated that people ruminate when they are sad, distressed or depressed, and that rumination increases the intensity of depressive symptoms throughout life (Carver and Scheier 1990; Ingram et al. 1987; Nolen-Hoeksema and Morrow 1991; Nolen-Hoeksema et al. 1993, 1994, 1999; Nolen-Hoeksema and Davis 1999; Pyszczynski and Greenberg 1987; Wood et al. 1990). In dysphoric patients, induction of rumination produces overestimation of future negative events (Lyubomirsky and Nolen-Hoeksema 1995), and a negative evaluation of oneself and of one's life condition (Lyubomirsky et al. 1998).

Interestingly, although rumination exacerbates depressive mood, subjects are motivated to focus on themselves, and to reflect on their feelings and difficulties in order to reach a better understanding of their condition. Indeed, Lyubominsky and Nolen-Hoeksema (1993) found that, following induction of rumination, dysphoric patients believed they could better understand themselves and their problems. However, in contrast with their expectations, patients were unable to find effective solutions to overcome challenges.

Summing up, although Nolen-Hoeksema does not explicitly investigate goals of rumination, her research identifies self-knowledge and understanding problems as the perceived functions of rumination.

2.2. Rumination as a self-regulation mechanism (Wells)

In 1996, Adrian Wells and Gerald Matthews proposed a metacognitive model of rumination in which metacognition ("cognition about cognition") both initiates rumination and mediates the link between rumination and depression (the S-REF model; Wells and Matthews 1996). Aimed at identifying the style of thinking behind the development of emotional disorders, Wells and Matthews described the "cognitive-attentional syndrome" (CAS), characterized by persistent negative thoughts, maladaptive coping mechanisms (including rumination), self-focus and thought monitoring processes. This syndrome is responsible for the mantainance of negative feelings and depressed mood, and metacognition "supervises" all stages of this process. Hence, within the S-REF model, metacognition, and not cognition, drives the development of emotional disorders. In other words, a dysfunctional cognitive evaluation of an event is not sufficient to elicit a specific emotional response, but instead, a higher-order metacognitive processing is required (Yilmaz et al. 2015). Within this model, rumination is viewed as a maladaptive coping strategy activated by metacognitive beliefs, which maintains the accessibility of negative, self-referent thoughts by means of negative metacognitive evaluations. Rumination develops following the detection of a conflict between personal goals and salient external stimuli or intrusive thoughts (self-discrepancy). While computation of self-discrepancy depends upon self-knowledge (knowledge of the self and its properties), the relevance of intrusive thoughts for the self is established through metacognitive knowledge. Hence, in Wells' theory, metacognitive processes are critical since the very first stages of information processing. Once incoming stimuli are compared with target states (goals), coping mechanisms work to solve discrepancy. The choice of a specific coping response is largely influenced by metacognition (metacognitive regulation) in that a coping style is selected and maintained by metacognitive beliefs about its implications. That positive beliefs about the usefulness of rumination might sustain rumination as a coping mechanism has been demonstrated in both depressed and healthy subjects (Papageorgiou and Wells 2003). Moreover, in healthy subjects, a specific effect of positive metacognitive beliefs on the link between self-discrepancy and rumination has been detected (Roelofs et al. 2007). The finding that metacognitive therapy, which is based on modifications of the negative-depressogenic metacognitive beliefs evoked by rumination and positive beliefs that trigger rumination, has been proven to be effective for the treatment of pathological rumination further demonstrates the relevance of metacognition (Callesen et al. 2014, Dammen et al. 2014, Wells et al. 2012). Interestingly, by analysing contents of positive metacognitive beliefs, some potential functions of rumination emerge. These functions include: i) gaining a better understanding of the depressed mood ("In order to understand depressive feelings, I need to ruminate about my problems"); ii) finding the possible causes or triggers of the depressive episode ("ruminating about my feelings helps me to recognize the triggers for my depression"); iii) modifying behavior ("ruminating about the past helps me to prevent future mistakes and failures"). Hence, it seems that rumination is activated by thoughts aimed at increasing the awareness of the events that lead to depression and to switch behaviour accordingly, and therefore it might have a highly adaptive valence. However, as soon as rumination starts, metacognitive beliefs about the potential negative consequences develop. Rumination is perceived as uncontrollable, pervasive and harmful by the individual, who focus the attention on the negative implications of rumination. Metabeliefs on the effects of extended rumination on social functioning are an important source of depressive feelings. Accordingly, negative metacognitive beliefs about rumination (as measured through the negative

beliefs about rumination subscales; Papageorgiou et al. 2001) are positively correlated with the development of depression, while, most importantly, there is no direct correlation between rumination itself and depression (Papageorgiou and Wells 2003). Hence, a first layer of dysfunctionality in the expression of rumination relies on the metacognitive beliefs that develop in response to its initiation. It is to note that rumination does not necessarily imply an emotional disorder, but is among the coping mechanisms that individuals might select when faced with self-discrepancy. In the S-REF model, rumination and worry are defined as "emotion-focused" (vs problem-focused) mechanisms of copiing, in that these processes are focused on the implications of the problem for the self and not on immediate screening for available solutions and strategies. Therefore, rumination (and worry) anchors attention on the self and increases the availability and accessibility of self-referent information, including negative automatic thoughts, which in turn may further boost rumination. It is thus evident that, when rumination is the only coping mechanism in which the individual engages, then several vicious loops leading to emotional disorders might develop. The balance between rumination and other coping strategies is a critical aspect to consider when analysing the transition to pathological rumination in the context of emotional disorders. Indeed, clinically-relevant rumination is characterized as being the prevalent modality for coping, and this results in i) neglecting other strategies for problem solving and ii) engaging in vicious loops associated with rumination and related enhanced self-focused attention. Hence, while the function of rumination, as indicated by the positive metacognitive beliefs that initiate it, might be that of tackling failure by engaging in problem solving, it ends up preventing other sources of coping.

The self-directionality of ruminative thinking impacts on the nature of competency and safety signals that regulate rumination, a process that is also under metacognitive control. Indeed, metacognitive beliefs shift control of rumination from external events to internal feelings, this mechanism being a further cause of increased self-focus and self-discrepancy.

Overall, the metacognitive model shares with other theories (i.e. Martin and Tesser 1996) the notion that rumination is a response to self-discrepancy, as rumination is thought to be elicited when a conflict between domains of the self is detected, and to be aimed at solving this discrepancy. However, the model adds a further layer of complexity by proposing that rumination is activated by metacognitive beliefs, shifting the focus from the content of ruminative thoughts to the content of metacognitive beliefs. In this view, metacognitive beliefs describe rumination as a mean to prevent failure in the future, through an in-depth analysis of mistakes that have led to failure and depression in the past.

2.3. Perseveration on unreachable goals (Davey)

Davey and collaborators developed the "mood as input hypothesis", where mood guides the decision to quit an activity or not (Davey et al. 2003, Startup e Davey 2001). These authors also found a significant relation between mood and the rule used to define goal achievement: "feel like continuing" or "as many as can" stop rules. In particular, experiencing positive affect induces the feeling of having accomplished a good performance, which prevents from putting further effort on the ongoing activity or task. Conversely,

when subjects experience negative affect, they assume that the activity has not been successfully performed. Hence, in response to negative affect, subjects are more likely to persist on a task until they feel it is completed, a mechanism behind many perseverative disorders (Davey 2006).

These results help explaining why many psychopathologies are characterized by repetitive thoughts or behaviors that the individual is not able to inhibit, as in the case of rumination (Davey 2006).

The propensity toward a "mood-as-input" style of thinking might be considered as a risk factor for depressive rumination (Startup and Davey 2001). Indeed, those who ruminate are more likely to experience a negative affect with respect to those who do not, which results in the application of the "as many as I can" stop rule. According to this interpretation, evidence so far show that rumination develops in response to mood deflection (Lyubomirsky and Nolen-Hoeksema 1993, 1995; Nolen-Hoeksema and Morrow 1993) and it is sustained by beliefs about the relevance of problem evaluation (Papageorgiou e Wells 2001, 2003).

Hence, according to the mood as input model, rumination arises from a mood state that influences the choice of a stop rule.

The mood as input theory would help to shed light on those cases where rumination persists because relevant goals are unreachable, or too abstract to be attained (i.e. elevated standards). Indeed, in this condition, perseveration may induce negative affect, which in turn further protracts the process of goal attainment.

3. Cognitive avoidance and problem solving as potential functions of rumination

3.1. The cognitive avoidance theory of worry (Borkovec)

A first elaboration of the concept of worry by Borkovec and colleagues (1983) defines it as a "a chain of thoughts and images, negatively affect-laden and relatively uncontrollable; it represents an attempt to engage in mental problem-solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes; consequently, worry relates closely to the fear process" (Borkovec et al. 1983, p. 10).

However, based on several experimental studies, the authors developed the "Cognitive Avoidance Theory" (Borkovec 1994, Borkovec et al. 1998) in which there is a redefinition of the process of chronic worry in generalized anxiety disorder (GAD)), as a cognitive avoidance response to perceived future threats. First of all, high worriers like GAD patients have a set of positive beliefs about worry (e.g. "worry helps to determine ways of avoiding bad events, to prepare for them, to reduce their likelihood, to problem-solve or to motivate performances") (Borkovec and Roemer 1995) that reinforce avoidant behavior.

According to Borkovec, the primary evidence in support of worry as an avoidance mechanism is in the focus of worry. People worry about possible future threats that might happen. As worry refers to events which are not currently happening, people may have little control over these events, and therefore they may mentally simulate problem solving. The authors report that worry-induced suppression of aversive images reduces somatic activation and emotional processing. Furthermore, worry leads to avoid arousal associated with anxious experience. This effect is mediated by the recruitment of attentional resources by worry.

For instance, "worry *requires attentional resource allocation, making it difficult to attend to something else and reduces the mismatch between information expected and information received"* (Borkovec and Roemer 1995).

Other studies (Sto ber 1998; Sto ber et al. 2000; Sto ber and Borkovec 2002) described worry as more abstract and less concrete (less image-producing) than other styles of thinking. Therefore, the abstractness of worry attenuates some aspects of negative emotional experiences and this mechanism helps to avoid aversive images and their arousing effects.

In summary, the functions of worry identified by the Cognitive Avoidance Theory are: i) perceiving possible future threats and ii) preparing to cope with them (Borkovec and Roemer 1995). Furthermore, worry helps to avoid processing of distressing phobic imagery (Borkovec 1994, Borkovec and Lyonfields 1993) and to avoid internal experiences, like emotions, as effects of anxious experience.

3.2. Avoidance and emotional control (Dugas)

The cognitive model of generalized anxiety disorder (GAD) developed by Dugas and colleagues identifies the *Intolerance of Uncertainty* (IU) as the key process involved in *worry*. IU is defined as "the tendency to react negatively on an emotional, cognitive, and behavioural level to uncertain situations and events" (Dugas et al 2004, p. 143). Individuals who are intolerant touncertainty have a set of negative beliefs about uncertainty and unexpected events (Buhr and Dugas 2002).

Dugas and colleagues hypothesized that there are two possible mechanisms through which IU promotes the maintenance and development of worry:

-directly by promoting a higher sensitivity to stimuli or situations that are ambiguous or that are suggestive of uncertainty
-indirectly through the relationship with positive beliefs about worry, negative problem orientation, and cognitive avoidance.

Regarding positive beliefs about worry, according to some authors (Borkovec and Romer 1995, Davey et al. 1996) there are different types of positive beliefs that promote excessive worry. Dugas et al. identified five groups ("worry ameliorates problem solving", "worry increases the motivation to act", "worry attenuates emotional reactions to future negative outcomes", "worry can directly alter the course of events", and "worry represents a positive personality trait") (Bakerman et al. 2004). Regarding the negative problem orientation, Dugas et al. (1996) observed that pessimism regarding problem-solving efforts increases catastrophic worrying. Furthermore, high worriers show a lack of confidence in their problem solving abilities (Robichaud and Dugas 2005b).

Finally, inspired by Borkovec's avoidance model, Dugas and colleagues conducted a series of studies to investigate the relationship between avoidance of emotional experience and worry (Backerman et al. 2003). The results confirm that avoidance of emotional experience is an important factor contributing to excessive worry. However, avoiding anxious arousal, rather than other emotional states,seems to be the specific factor involved in high-level worry (Dugas and Koerner 2005).

Dugas et al. (2004) proposed a conceptualization of worry as "the result of competing cognitive-motivational states", and as "an expression of various cognitive-motivational conflicts that become challenging for the individual". In particular, patients with GAD experience aconflict between positive and negative beliefs about worry. Indeed, while worrying produce some beneficial effects, it also produces a considerable amount of stress and interferes with its functionality.

In summary, the functions of worry identified by Dugas et al. (2004) can be summarized as follows: to promote positive outcomes such as finding the solution to a problem; avoid negative outcomes; prepare to the worst scenario and maintain control over potential negative emotions (Dugas and Koerner 2005); reduce uncertainty about future threats (Dugas et al. 1997).

4. Rumination as a goal-directed strategy

4.1. The goal progress theory (Martin and Tesser 1996)

Although in some cases rumination is clearly dysfunctional (i.e. it interferes with goal achievement), we must consider that rumination itself seems to serve goals. Martin and Tesser (1989, 1996, 2006) defined rumination as a problem solving strategy whose aim is to solve discrepancy between the current and the expected progress toward a goal. Although repetitive thoughts are "unwanted" in that they emerge in the absence of environmental cues, the development of rumination is closely related to the individual's need to achieve his goals. In this perspective, ruminating is adaptive insofar it is activated when other more functional trajectories to an high-order goal are unavailable. Therefore, the development of rumination would be caused by a failure to progress toward relevant goals (Carver and Scheier 1990), rather than a failure to reach the goal. If the subject fails to reach the goal, goal-related information remains easily accessible (Zeigarnik 1938, Bruner 1957, Higgins et al. 1977, Martin et al. 2001), which causes neutral stimuli to trigger rumination. Based on this theory, rumination acts as a mechanism of self-regulation guided by high order goals. Indeed, maintaining goal-related information easily accessible facilitates problem solving and further motivates people toward their goals (Kuiken and Mathews 1986-87, Schooler et al. 1995; Bowden and Beeman 1998). Accordingly, rumination ends when the high-order goal is reached, when enough progresses toward the goal are made or when the individual gives up in the process of goal attainment.

Summing up, the goal process theory suggests that failure to reach a high-order goal produces several consequences including the need to develop new strategies to reach the goal, to reevaluate goal's relevance and to adapt behavior to different goals. Rumination arises when the subject repeatedly uses a particular thinking process. Ideally, through rumination the individual would resume his trajectory toward the goal. A main implication of this perspective is that the object of rumination (i.e. the unachieved goal that triggers rumination) is a priority to the individual. In other words, the presence of rumination is an indicator of an individual's goal hierarchy.

4.2. The specific functions of rumination (Watkins)

Watkins (2016) defines rumination as a "*common, normal, and sometimes helpful response not limited to people with psychological disorders*". However, the author points out that when rumination is no

more characterized by concrete, process-focused, and specific thoughts (helpful style) it can become maladaptive, characterized by abstract, evaluative thinking (unhelpful style; Treynor et al. 2003; Watkins 2004; Watkins and Baracaia 2002; Watkins and Moulds 2005; Watkins and Teasdale 2001, 2004). Few research (Treynor et al. 2003; Watkins 2004; Watkins and Baracia 2002; Watkins and Moulds 2005; Watkins and Teasdale 2001, 2004) suggest that in the case of depression, maladaptive rumination increases overgeneralization, impairs problem solving, and exacerbates depressed mood.

On the basis of some of the current theoretical models of rumination (*Control Theory*, Martin and Tesser 1989, 1996; *Response Styles Theory*, Nolen-Hoeksema 1991; *Rumination as a mental Habit*, Hertel 2004) Nolen-Hoeksema and Watkins (2014) developed the Habit-Goal Framework Theory.

As previously described, the RST hypothesizes that depressive rumination, conceptualized as a stable, enduring, and habitual trait-like tendency to engage in repetitive self-focus, is activated in response to depressed mood. Instead, according to the Control Theory (Martin and Tesser 1996), rumination develops when a discrepancy is perceived between one's current status and one's goals. However, Martin and Tesser also described a form of adaptive rumination which consists of repetitive, goal-oriented thinking that promotes a progress toward the goal. In contrast, the authors define rumination maladaptive when it only serves to make the discrepancy between a desired and the current status more obvious.

The Control Theory hypothesizes, different levels of abstraction in the goal hyerarchy: to more abstract levels the focus is on why there have been or are executed; while the more concrete levels there is a greater relevance to the context and the focus is on how to take place or should be performed. Watkins and colleagues (Watkins et al. 2008, Watkins and Moulds 2005) have found that extended abstract processing of negative information leads to an exacerbation of emotional reactivity, increases personal relevance of the event and impairs problem-solving because of a limited availability of alternative plans.

According to Nolen-Hoeksema and colleagues (2008), rumination may be seen as a cognitive habitual response to negative mood. Watkins and Nolen-Hoeksema (2014) emphasized the relevance of conceiving rumination as a mental habit (Hertel 2004). This interpretation explains why it is so difficult to quit ruminating. In the Hertel's habit model (2004), rumination is defined as a thinking habit, and its initiation can often occur automatically, without conscious awareness or effort. This model suggests that habits are resistant to changes of goals, outcomes, and intentions, and they are difficult to restrain. Hence, even if goals are ridefined, rumination will be maintained despite its negative consequences which interfere with an individual's attitudes and intentions.

Consistent with the habit hypothesis, Watkins and Baracaia (2001) observed that rumination emerges without a conscious intent. Moreover, depressed patients report that they are unable to control ongoing rumination. Hence, being frequent, unwanted and repetitive, rumination matches the defining features of a habit.

When goal-directed behaviors are repeated in specific contexts, they may become habits. Habits are triggered by specific contextual cues (Wood and Neal 2007), rather than by implicit or explicit goals.

Depressive rumination may become habitual when ruminative episodes are contingent to a negative mood state characterized by repetitive, passive, negative and abstract thoughts. Once contingency is established, negative mood becomes a trigger for rumination. In contrast, rumination is unlikely to become a habitual trait if the individual uses a concrete action-oriented thinking when faced with a goal-discrepancy.

In this regard, it seems that in the contexts where active responses are not continuously reinforced, passive responses are more likely to develop. Indeed, repeated failures following active responses greatly reduce the value of being active.

In conclusion, according to Watkins, an individual who ruminates in response to a difficult situation does not necessarily develop a habitual depressive rumination, but rather, rumination may develop *"as a normal and adaptive response to unresolved goals"* (Watkins and Nolen-Hoeksema 2014). It seems that rumination evolves into a habitual depressive rumination only when "unhelpful episodes of repetitive thought are contingent on the associated context (eg, sad mood)" and when "there are ongoing unresolved goals that afford the opportunity for repeated episodes of repetitive thought in a co-occuring context, leading to repetitive thought being contingent on negative mood "(Watkins and Nolen-Hoeksema 2014). Indeed, it is assumed that contextual factors (chronic stress, abuse, trauma) leading to chronic frustration of important personal objectives and therefore to experience the contingency between repetitive thought and negative mood, interact with individual differences (i.e. restricted repertoire of coping strategies), in determining the tendency to develop habitual depressive rumination.

Although Watkins was initially inspired by the conceptualization of rumination as a mental habit, he subsequently refined his approach on the basis of the functions of rumination in patients with depression and anxiety identified by the clinical experiences. He underlined that "often patients are unaware of the potential functions that may be operating to reinforce their rumination" (Watkins 2016). Furthermore, "functions are not necessarily independent: they can be overlapping, and for any single patient, rumination may have several potential functions" (Watkins 2016).

Within RFCBT, rumination is conceptualized as "escape and avoidance behaviour that has been reinforced in the past by the removal of aversive experience, or because it has perceived or actual functions" (Watkins 2016).

Rumination may be effective for a specific function, but it also has heavy costs, including exacerbation of anxiety symptoms or depression, reduced motivation, low self-confidence.

For example, if a patient ruminate to reduce anger and aggressive feelings, but he develops rumination-induced depression, relaxation and assertiveness may be used to replace rumination and prevent depression (Watkins 2016).

The potential functions of rumination observed by Watkins during 15 years of developing and evaluating RFCBT include

(1) "seeking understanding and insight": try to understand the reasons for what happened through a rumination characterized by "why" questions about events. The aim is to prevent adverse events from happening again and to feel a sense of control or certainty.

(2) "Self-motivation": dwell on personal difficulties in an attempt to avoid unwanted behaviors. The consequence is that this approach, in the long-term, will lead to more negative self-evaluations.

(3) "Planning and preparation" for future events, for example, by imagining what will happen and running through possible responses with the risk that the plans will never be realized. In this case rumination becomes a way to avoid dealing with the current situation.

(4) "Avoiding an Unwanted Self" or that kind of person the patient is afraid of being by ruminating on unwanted aspects of himself. The aim is to remind himself to act differently.

(5) "Avoiding the challenges of a job or the boredom of the daily routine" by focusing on an inner life made of memory, images, and thoughts. This practice could be detrimental if it becomes frequent and prolonged.

(6) "Avoiding the risk of failure or humiliation" by prolonged dwelling on situations that are perceived as challenging, difficult, or risky. The consequence is that the individual is not actually taking action but rather, action is procrastinated.

(7) "Preventing criticism and anticipating potential negative responses" by trying to mind read and to second-guessing what might happen next.

(8) "Control of feelings": Watkins observed complex and dynamic patterns of emotions associated with rumination that create reciprocal loops. For example "a patient feels down and ruminates in a way that makes her angry, but then she ruminates about her anger and how insensitive she is, and the begins to feel guilty and down, and so on" (Watkins 2016).

(9) "Making excuses and generating rationalizations" by dwelling on all the difficulties and problems that a patient faces. The consequence is that this practice further increases thinking, rather than promoting decisions or actions.

(10) "Gathering evidence and generating justifications" by dwelling on instances in which the standards of the patient have not been met, and on why things should be the way he wants them to be.

It is important to note that avoiding an unwanted self, which Watkins identifies among the functions of rumination, may rather represent a high-level abstract goal. For instance, ruminating on anxiety may have the function to cope with that negative emotion in order to avoid being someone vulnerable (which is the avoidance goal). This interpretation is consistent with Carver and Scheier's (2011) goal hierarchy model, where "be goals" (achieving a desired self or avoiding an unwanted self) stands on the top of the hierarchy.

5. Research on rumination and goals

Although evidence so far points to the relevance of personal goals in the development of rumination, few authors have addressed the link between rumination and goals. Among this earlier research on rumination, many studies support Martin and Tesser's Goal Progress Theory (1996).

As our main purpose is to analyze rumination within the frame of goal hierarchy, in the next chapter we will briefly describe the work of those authors who raised the idea that rumination results from the failure to reach high-order goals. Within this frame, to obtain high order goals the individual must first reach those goals that are lower in the hierarchy (i.e. not thinking about a polar bear, not spending too much money on shopping). Rumination stops when high order goals have been achieved, regardless of the lower order goals involved.

So far, many studies have provided evidence to support this hypothesis (Martin et al. 1993, McIntosh et al. 1995, Lavallee and Campbell 1995, Koole et al. 1999).

In particular, some authors have tested the idea that rumination focused on unreached objectives is more intense when those objectives are related to high-order goals. McIntosh et al. (1995) demonstrated that when the attainment of a lower order goal (i.e. losing weight) is instrumental to obtain a higher order goal (i.e. being happy), rumination is more severe than when lower- and higher-order goals are unrelated. However, these studies do not necessarily provide an empirical basis to Martin and Tesser's theory, because personal evaluations of goals in relation to rumination is not directly investigated.

To address the link between rumination and goals, Lavallee and Cambell (1995) asked students to list their life goals. One month later, subjects were required to keep a daily journal to describe specific events that triggered mood states. The results showed that rumination and negative mood are more likely to develop when negative events involve relevant goals than when negative events are unrelated to relevant goals.

Martin et al. (1993) further addressed the hypothesis of a link between rumination and goal hierarchy. The authors start from the assumption that suppressed thoughts are hyperaccessible (Wegner et al. 1987). However, in line with the goal progress theory, they hypothesize that hyperaccessibility results from the failure to achieve the goal of self-control, rather than being a consequence of thought suppression. To test this hypothesis, the authors investigated whether boosting self-efficacy in thought control decreased the accessibility of suppressed thought. Briefly, subjects were divided into three groups: group 1 was given the instruction to "think about a polar bear"; in group 2 thought suppression was induced by asking not to think about a polar bear; group 3 was given the same instructions than group 2 but received a positive feedback about their ability to suppress thoughts (you were good at suppressing the thought of the polar bear, you are good at thought control). Following this experimental manipulation, subjects were asked to identify words (of which some were related to polar bears) letter by letter. The results showed that subjects in group 2 (thought suppression without feedback) were faster at identifying words related to suppressed thoughts, which suggests hyperaccessibility of information related to suppressed thoughts. Hence, if subjects were told that the goal of thought control was achieved, hyperaccessibility of suppressed goals did not develop. Rumination should decrease accordingly.

Koole and collaborators (1999) shed light on the link between rumination, self affirmation and affect modulation. Drawing from Steele's (1993) self-affirmation theory, which claims substitution of blocked goals with accessible goals related to positive self-image as a potential strategy to stop rumination, the study explores the benefits of self-affirmation against rumination. In particular, Kooles and collaborators (1999) tested the hypothesis that promoting self-affirmation blunts goal-related information processing, which is a main trigger of rumination. Moreover, they analysed alternative mechanisms that are thought to mediate the beneficial effects of self-affirmation in rumination therapy. In experiment 1, goal frustration was induced by means of an unsolvable intelligence test and then in a subgroup of subjects self-affirmation was evoked. Accessibility of goal-related information was assessed by testing the reaction to words explicitly (exp 1) or implicitly (exp 2) related to the frustrated goal. A main finding of the study was that achieving self-affirmation significantly blocks the accessibility

of information related to a frustrated goal. Overall, this study strengths the notion that promoting self-affirmation may inhibit the cognitive process behind the expression of rumination by allowing achievement of a higher-order goal of positive self-image.

Morberly and Watkins (2010) conducted one of the first experience-sampling study to examine negative affect and ruminative self-focus simultaneously as a function of goal appraisals and individual differences in depressive symptoms and trait rumination.

Based on Martin and Tesser's (1996) model, the authors hypothesised that negative affect and ruminative self-focus would be associated with difficulties in goal progress, particularly when important goals are involved. In particular, they expected that high levels of ruminative self-focus would be associated with low levels of goal attainment, and that this relationship would be stronger for more important goals than for less important goals. Futhermore, the expectations were that negative affect would be associated with low ratings of goal-related success, and that people would experience the most negative affect when reporting low levels of success in the pursuit of important goals. They analysed data from 103 participants (75 women) who reported their negative affect, ruminative self-focus, and goal appraisals at random intervals eight times a day for one week. To investigate individual differences in depressive symptoms and trait rumination participants completed the Beck Depression Inventory-II (BDI-II; Beck et al. 1996) and the Response Styles Questionnaire-Ruminative Responses Scale (RSQ; Nolen-Hoeksema and Morrow 1991). The results showed that goal importance was positively correlated with both negative affect and ruminative self-focus. Goal attainment was negatively associated with both negative affect and ruminative self-focus. A combination of high goal importance and low goal success was associated with the highest levels of negative affect and marginally associated with ruminative self-focus. Trait rumination was significantly and independently associated with both negative affect and ruminative self-focus, but depressive symptoms were significantly and independently associated with negative affect only.

Moberly and Watkins' conclusions were that "goal importance moderated the relationship between perceived success and focus on problems, but did not moderate the relationship between perceived success and focus on feelings. When important goals go badly individuals are more likely to ruminate about problems, but the occurrence of emotion-focused rumination is associated with factors above and beyond the interaction of goals success and goal importance". These conclusions are consistent with Martin and Tesser's theory of rumination for problem-focused, but not for emotion-focused, rumination.

However, the finding that emotion-focused rumination occurs regardless of goal success does not necessarily rule out the possibility that ruminating on feelings has a goal. Indeed, we may hypothesize that emotion-focused rumination promotes emotional control and regulation in order to achieve abstract goals (ie. decreasing anger is instrumental to avoid being aggressive). Given the within-person variation in "be goals", it may be difficult to identify and measure such personal and subjective goals.

Finally, Thomsen et al. (2011) conducted three studies to investigate how rumination and reflection are related to internalized self-regulation and goals. Based on Tranpnell and Campbell's (1999) conceptualizations and operationalization of rumination and reflection, the authors hypothesized that rumination (unconstructive repetitive thoughts) is related to less internalized self-regulation and goals while reflection (constructive repetitive thoughts) is related to more internalized self-regulation and goals. In addition, the authors hypothesized that when the contents of goals are internalized, conflict and ambivalence are reduced, resulting in a decrease of rumination and an increase of reflection.

In the first study, they analysed data from 176 participants (143 women) who completed the Rumination-Reflection Questionnaire (RRQ; Trapnell and Campbell 1999) and the General Causality Orientation Scale (GCOS; Deci and Ryan 1985). The RRQ was used to measure rumination and reflection and the GCOS was used to measure internalization of self-regulation.

In the second study, 677 participants (472 women) completed the RRQ and the GCOS. In addiction they completed: the Personal Striving Assessment Packet (PSAP; Emmons 1990) which was used to measure content and characteristics of goals; the Striving Assessment Scale (SAS; based on Emmons 1999) used to measure goal ambivalence; the Striving Instrumentality Matrix (SIM; based on Emmons 1999) through which participants completed conflict ratings for their five most important strivings.

Moreover, participants were asked to rate their personal strivings on four 7-point scales measuring the degree of internalization (based on Sheldon and Kasser 1995). In the third study, 83 participants (76 women), the authors asked participants to list four goals, rate these goals based on internalization (questions based on Sheldon and Kasser 1995) and rate rumination and reflection (questions based on the RRQ, Trapnell and Campbell 1999) specifically related to each goal.

The authors found support for the hypothesis that less internalized self-regulation and goals are related to rumination. However, the idea that ambivalence and conflict partly explain the associations between rumination, reflection and internalization was not supported. Regarding reflection, the authors found out that it was associated with more internalized self-regulation, more internalized goals and more approach goals, although the evidence were weaker. The authors conclusions were that "internalization is central for distinguishing between rumination and reflection. The current studies thus testify to the advantages of integrating goal-based theories of self-focused repetitive thoughts with theories emphasizing internalization processes in self-regulation".

Consistent with a functionalist view, Ciarocco and colleagues (2010), taking up Mikulincer's (1996) classification of rumination, conducted a study aimed at testing whether different forms of rumination may improve psychological health. The categories of rumination identified by Mikulincer (1996) are three. Action rumination is task oriented and focused on how to achive the goal. State rumination focuses on current feelings and implications of failure. Finally, task-irrelevant rumination would aimed at diverting attention from failure by focusing on things unrelated to the blocked goal (Mikulincer 1996). The hypothesis of Ciarocco et al. was that action rumination should improve performance unlike state and task-irrelevant rumination.

The authors conducted three experiments. In all three experiments, a task specifically designed to investigate creativity was used as premeasure and postmeasure test. In the first experiment, they used two creativity tasks, adapted from the Torrance Test of Creative Thinking (Torrance 1966), while in the second and in the third

experiment they used two word search puzzles.

Subjects were given negative feedbacks upon task completion. Following negative feedback in experimenti 1 and 2, one type of rumination was selectively activated (state rumination condition, action rumination condition and task-irrelevant condition). Instead, in the third experiment stimulations were provided to activate any type of rumination. This latter manipulation was aimed at activating the type of rumination each participant used in their daily lives and to avoid imposing a specific type of rumination.

The results of all three experiments support the idea that rumination can be beneficial. Specifically, action rumination led to significant improvements in performance, whereas state and task-irrelevant rumination had no such beneficial effects.

The authors suggested that rumination might be advantageous from an evolutionary perspective. In particular, thinking about one's own mistakes after a failure might help learning from experience, improving performance and increasing the probability to succeed in the future. Hence, rumination would be a key adaptive process for natural selection that may turn into a pathological condition when specific variables occur. Importantly, the study supports the distinction between constructive reflection and pathological rumination (Watkins 2008), Moreover, evidence so far strengthens the functionalistic perspective that considers rumination as a process driven by self-relevant goals and characterized by specific functions.

6. Conclusion

The aim of this review was to examine theoretical models and scientific evidence on rumination in order to understand its function and goals.

Briefly, rumination has some important features: it is habitual, it focuses on a specific theme, it is a transdiagnostic process, which means that rumination may occur in different psychiatric conditions (Watkins 2016). Beside the specific aspects that motivate people to engage in rumination, we should keep in mind that rumination develops in healthy people and it is a common mental attitude. This implies that rumination is not necessarily maladaptive, as thinking on a problem or on aspects of the self can help overcoming challenges and modify behavior. In other words, rumination is adaptive insofar is flexibly used within a set of strategies, but it might become excessive and dysfunctional when used in excess.

Overall, theoretical models accurately define the functions of rumination, and evidence so far has greatly enhanced our understanding of why people ruminate. The most commonly reported functions of ruminative thinking include i) understanding an event, ii) solving a problem, iii) preparing to face a negative scenario, iv) avoiding aversive situations or self-regulating (Wells et al. 2012, Watkins 2016).

Rumination focused on emotional states and related physical reactions mostly concerns mood antecedents (so, the motivations behind the development of such emotional or physical reactions). In other cases, rumination's content involves relevant goals which have not been reached or that are currently unreachable, and negative outcomes of life events

While we know that rumination is an extremely relevant strategy for people, the goals of rumination are yet unclear.

Among the authors that have addressed this issue, Nolen-Hoeksema (2000) claims that rumination develops as a cognitive strategy to overcome negative feelings and emotions and to cope with depressive state. In these cases, rumination seems to be sustained by the belief that thinking on problems would help have a deepest understanding of such problems and more in general, to increase self knowledge. However, rumination becomes dysfunctional as hyperfocalization on problems and negative feelings further lowers mood.

The Mood as Input Theory (Davey et al. 2003) points to the role of stop rules in the maintenance of repetitive thinking processes, including rumination. If the subject is feeling down, depressed, he is less likely to feel that a goal has been achieved or that a good performance has been accomplished. The application of this so-called "as many as I can stop rule" implicates that the subject will persist on elaborating the problem through rumination, which in turn mantains negative feelings and the unflexible use of the same stop rule. The Cognitive Avoidance Theory and the Intolerance to uncertainty theory, elaborated by Borkovec et al. (2004) and Dugas e Koerner (2004), respectively, both suggest that, as previously said for rumination, worry is perceived as a functional strategy to cope with potential future threats and avoid emotional activation and control uncertainty related to such threats, which becomes dysfunctional and maladptive as it recruits attentional resources and becomes unstoppable.

Wells (2012) addressed the role of goals in the development of rumination, as he hypothesized that rumination is an emotion-focused copying strategy that develops when a discrepancy is detected between a current status (whose relevance for the self is established through metacognitive knowledge) and a reference goal. Interestingly, the content of metacognitive beliefs suggests that rumination, at least at the beginning, is highly adaptive (and indeed this mechanism works in healthy subjects as well), because it would help being more aware of what went wrong in the past and modify behavior accordingly.

The role of rumination within this model is consistent with Carver and Scheier's view of behavior as a self-regulatory process aimed at reducing the discrepancy between a current status and a desired status or goal.

Similarly, Martin and Tesser describe reducing a discrepancy among the functions of rumination, but they propose that the discrepancy is between the current progress toward a goal and the expected progress. In other words, what drives rumination is the degree to which the individual has moved toward the goal, not the achievement of the goal. However, using Carver and Scheier's model as a reference, we see how the value of goals, their position in the individual goal's hierarchy is critical to define the relevance of rumination, as the highest is the goal in the hierarchy, the most is progression toward that goal critical, and therefore, the most important is to act on the discrepancy between current and expected progress relevant. On the other way around, rumination informs on the value of the goal involved.

On the other hand, other theories in the field, such as the work of Martin and Tesser proposed that rumination activates when the subject fails to progress toward personal goals. Similarly, Watkins has suggested that rumination develops when a goal is unachievable.

However, we may still reconcile these views by considering that psychopathologies may affect the content of ruminative thoughts and the balance between rumination and other problem solving strategies.

A further layer of complexity in integrating goals and functions of rumination is that goals are organized in hierarchy, where lower-order and intermediate goals

must be achieved in order to reach higher–order and abstract goals, which stand on the top of the hierarchy. Some of the "functions" of rumination described by current theories are instrumental to reach higher order goals, which might be either concrete or abstracts or to avoid antigoals. For example, I might ruminate on an episode of anger in order to understand why I became angry and how to react differently in the future, with the overall goal of being someone who is more tolerant.

We might thus say that rumination belongs to the wide set of adaptive coping strategies that individual use to pursuit their goals, which might become maladaptive in some conditions, such as, as suggested by Davey and Nolen-Hoeksema, when negative feelings interfere with a flexible use of rumination. Within this frame, rumination persists as long as the goals which are higher in the hierarchy are perceived as unreachable or are actually unreached. This idea is consistent with the previsouly described scientific evidence which demonstrate that achieving a high order goal blocks rumination induced by a lower order goal (Martin et al. 1993, McIntosh et al. 1995, Lavallee and Campbell 1995, Koole et al. 1999).

Studies so far suggest that rumination is involved in the process of achieving abstract goals, and particularly, rumination develops to facilitate the achievement of intermediate goals that are instrumental to reach a desired self or to avoid an unwanted self. If I aim to be someone competent (abstract goal related to desired self), then I must avoid failures (intermediate goal). By ruminating on why I failed and how to minimize the risk of failing in the future, I increase the probability of succeeding, and therefore, I proceed toward the attainment of a competent self.

As far as emotion regulation is concerned, emotion-focused rumination might seem purposeless. We may explain these cases by considering that abstract goals are very personal, which makes it very difficult to investigate them in an experimental context, and the patient might be unaware of them (e.g. "be" goals). This hypothesis may help to explain Moberly and Watkins' (2010) results, which show no association between emotion-focused rumination and the attainment of concrete goals. In addition, a habit-like mechanism might be involved: rumination is triggered by conditioned cues, previously neutral stimuli that have been coupled with goals or unreached goals - related information.

Overall, research and clinical findings converge in claiming that patients might use rumination either to deal with concrete situations (problems, challenges or failures) or to change internal states (emotions, feelings, self-image) with the aim of achieving salient higher-order goals.

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