# Perseverative cognition : the impact of worry on health

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# Chapter 1

**General Introduction**

## The perseverative cognition hypothesis

In daily life, many people ponder about things that have happened in the past or about things that might occur in the future. In contrast with animals, human beings are capable of thinking minutes, hours, months and years back and ahead. This ability comes in handy when planning one's holiday or when deciding what jobs one wants to pursue. Also, it can be a pretty enjoyable experience to remember pleasant events or to look forward to such events. Yet, this ability to think back and ahead also has a downside: it gives humans endless opportunities to keep thinking about stressful events that lie either in the past or in the future. For a majority of people worries about upcoming stressful events are indeed a common experience in daily life, also when these events never actually happen.

Frequent worries about the future do not come without costs. Since the early '80s, it has been increasingly recognized that severe, pathological worry is crucial in the onset and maintenance of anxiety and mood disorders (Watkins, 2008). More recently, pathological as well as non-pathological worry has become a growing area of interest in stress research (Brosschot, Gerin, & Thayer, 2006), the major aim of which is to explain why stressful events can make us sick. Stress research in the past fifty years had been dominated by the reactivity model of stress, stating that frequent exaggerated stress-related physiological activity *during* the experience of a stressful event is detrimental for one's health (Linden, Earle, Gerin, & Christenfeld, 1997). For example, people who show a strongly enhanced heart rate during stressful events such as an exam would be vulnerable to develop cardiovascular problems in the long term. Yet, in the last ten years a shift in paradigm could be observed towards prolonged activation models (Linden et al., 1997; Schwartz et al., 2003; Pieper & Brosschot, 2005), stating that stress-related physiological activity that is enhanced *in anticipation of* or *after* stressful events is crucial in the causal chain from stressful events to disease. This focus on the temporal aspects of the stress response was already advocated by early stress researchers (Selye, 1951), but has remained understudied for years. From a prolonged activation model point of view, the total duration of the physiological stress response, and not so much its initial strength, is the most important factor in determining whether stress affects one's health. A central venture for stress researchers is therefore to disentangle why and under what circumstances stress-related physiological activity is prolonged beyond the presence of actual stressful events. Working from within the framework of the prolonged activation model, Brosschot, Gerin and Thayer (2006) proposed that worry is a likely candidate to produce sustained stress-related physiological activity in daily life. Worry can be regarded as a recurrent or persistent cognitive representation of a stressor, termed 'perseverative cognition', and this perseverative cognition could serve as a mechanism that prolongs physiological activation due to stressor. According to the 'perseverative cognition hypothesis' perseverative thoughts, like worry, produce sustained stress-related physiological activity

which in turn leads to health problems. In other words, stressful events cannot affect one's health, unless people worry about these events. Figure 1 depicts the perseverative cognition hypothesis in a model.

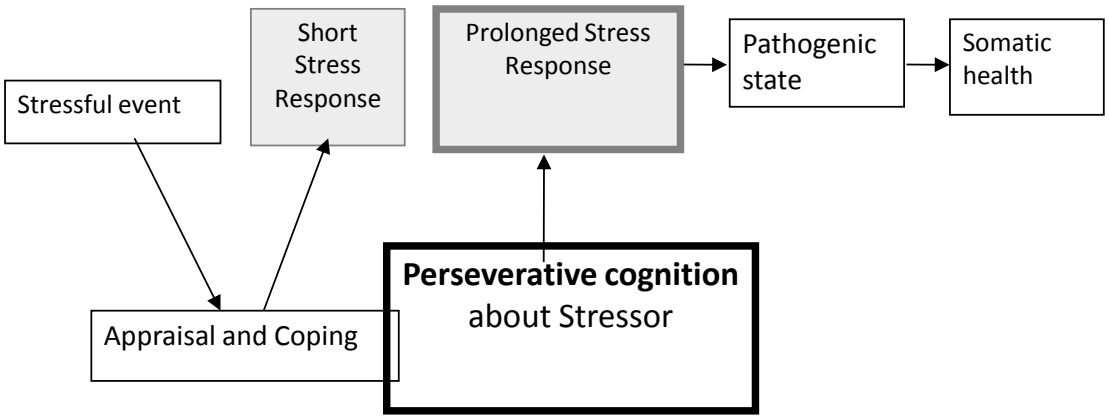


*Figure 1*. The perseverative cognition model. Only physiological stress responses that are prolonged by worry can lead to a pathogenic state in which people are vulnerable for the development of somatic health problems. Adapted from: Brosschot, Gerin & Thayer (2006).

Evidence for the perseverative cognition hypothesis is accumulating. Recent research shows that worry in daily life is associated with enhanced cardiac activity (in combination with stressful events having similar adverse effects as smoking; Pieper, Brosschot, van der Leeden, & Thayer, 2007; Brosschot, van Dijk, & Thayer, 2007). Furthermore, worry has been found to be predict somatic health complaints like fatigue, neck pain and headache, and this effect could be reduced by a simple worry postponement intervention (Brosschot & Van Der Doef, 2006; Jellesma, Verkuil, & Brosschot, 2009; see chapter 2 for a more thorough review). Yet, the existing studies suffer from limitations that restrict conclusions regarding several crucial aspects of the perseverative cognition model. This thesis addresses several of these aspects.

Firstly, the larger part of studies investigating the effects of worry on somatic health outcomes have relied on self-report trait-worry questionnaires; 15 out of 24 studies reviewed by Brosschot, Gerin and Thayer (2006) solely relied on trait questionnaires. Yet, the extent to which such trait questionnaires are related to the frequency and duration of worry episodes as measured with momentary assessments had not been investigated before this dissertation (but has been now,

as reported in chapter 3). Thus the significance (exact meaning) of the larger part of the current evidence therefore remains unknown. If trait worry questionnaires do not correspond with worry in daily life, the validity and reliability of most current evidence could be questioned. Therefore we used real life, momentary measures of worry to study its prospective relationship with somatic health complaints (chapter 4).

Secondly, only little is known about the relation between daily worry and health outcomes in populations vulnerable to develop stress-related health complaints, such as teachers or nurses (chapter 4), or in people already suffering from severe stress (chapter 5). It is also not known whether the potentially adverse effects of worry can be reduced in these groups. Brosschot and Van der Doef (2006) already showed that a simple worry postponement intervention could reduce the adverse effects of worry on health complaints. Worry plays a pivotal role in the development and maintenance of not only anxious and depressed mood, but likely also in somatic complaints. In a time where a significant amount of employees is suffering from work-related stress and worries (Monsterboard, 2008), and where as yet few evidence-based short and easy to administer stress management interventions are available (Jorm & Griffiths, 2006), it seems of particular interest to test whether such an intervention would also be effective in a clinical population suffering from severe work stress (chapter 5). Showing that a simple worry intervention is effective in reducing somatic complaints, as well as anxious and depressed mood, could potentially provide clinicians, like occupational physicians and general practitioners, with such an evidence-based intervention. Furthermore, it would provide evidence that the perseverative cognition hypothesis holds true in a clinical population too.

Thirdly, whereas ambulatory studies have consistently found associations between *state* (daily) worry and cardiac activity (e.g., Pieper et al., 2007; Brosschot et al., 2007), laboratory studies have yielded inconsistent results (see chapters 6 and 9). Although most studies have shown that *trait* perseverative cognition predicts slowed cardiovascular recovery after stressful events (Glynn, Christenfeld, & Gerin, 2002; Gerin, Davidson, Christenfeld, Goyal, & Schwartz, 2006; Key, Campbell, Bacon, & Gerin, 2008), several of these studies did not find an association between state worry and slowed cardiovascular recovery (Key et al., 2008; Gerin et al., 2006). One possible explanation is that in high trait worriers worrying occurs very automatically and without conscious awareness. If this is true, such implicit worry cannot be assessed via self report methods that rely on information that one can consciously reflect upon and report. According to the definition of perseverative cognition, its pathogenic ingredient is the 'cognitive representation of a stressor', which can theoretically be conscious as well as unconscious (Brosschot et al., 2006). Whereas all studies concerning the perseverative cognition hypothesis have focused on its explicit, conscious forms, no studies have addressed the possibility that implicit or unconscious forms of perseverative cognition slow down

cardiac recovery (see also chapters 2 and 6). If perseverative cognition like worry indeed occurs unconsciously and slows cardiac recovery, this would open up a new and promising venture for stress research, because a large part of cognitive processing in daily life occurs without conscious awareness. This could potentially mean that by focusing on consciously perceived stress, researchers have been focusing on the 'tip of the stress-iceberg'.

Fourthly and finally, as a consequence of worry research only being started recently and the heavy focus on trait-approaches, only very few attempts have been made to study the mechanisms via which worry exerts its detrimental influence on both mental and somatic health. In this thesis, three studies are reported that have been conducted to address these possible mechanisms (chapters 7 – 9).

**Thesis outline**

The main aim of this thesis was twofold. First, realized in part 1, to further test the perseverative cognition hypothesis, three studies were conducted to test whether worry predicts adverse health-related outcomes, while addressing the above mentioned limitations. In these studies, health-related outcomes were operationalized as either somatic health complaints (chapters 4 and 5) or slowed cardiac recovery (chapter 6). Health complaints and slowed cardiovascular recovery are both associated with morbidity and mortality (Sha et al., 2005; Kivimaki et al., 2006; Jae et al., 2008). The second aim of this thesis, realized in part 2, was to examine possible pathways or mechanisms that could explain or add to the findings from the first part of this thesis (chapters 7 – 9; see below for more details).

The thesis starts with a theoretical review summarizing recent evidence regarding the perseverative cognition hypothesis and providing an integrative theoretical framework on perseverative cognition (chapter 2). In chapter 3, the predictive validity of three widely used trait worry questionnaires is investigated in a large sample of university students. In chapter 4, the effects of momentary assessed stressful events and worry episodes on somatic health complaints is examined in a sample of primary and secondary school teachers. The specific prediction was tested that worry mediates the adverse health effects of stressful events. In chapter 5, the effectiveness of a simple worry postponement and disengagement intervention was tested in a sample of clinical outpatients suffering from severe work stress. In this randomized clinical trial, patients that were awaiting stress management therapy were randomly allocated to either receive the worry postponement and disengagement intervention before the onset of the stress-management therapy or one out of two control conditions, that is the registering of worry episodes or a waitlist control. By experimentally trying to reduce worry, it could be tested whether worry was causally related to somatic health complaints. Furthermore, besides testing the short term effects of this intervention,

the additive effects of this worry intervention on the stress management therapy were investigated. In chapter 6 the effects of explicit and implicit worry on cardiac recovery after a stressful event were investigated. We hypothesized that trait worry would predict slowed cardiac recovery after stress, and that this effect would be mediated by explicit and implicit state worry experienced during the recovery period following the stressful event.

Whereas the first part of this thesis is aimed at examining whether worry is related to health outcomes, the second part of this thesis is aimed at clarifying the mechanisms behind the relation between worry and health (chapters 7 and 9) and also the mechanisms behind the worry process itself (chapter 8). Each of these three studies described in this part corresponds to a study reported earlier in this thesis and targets a specific mechanism that adds to a fuller understanding of how worry affects our health, thereby extending and specifying the perseverative cognition model. Below, the aims or these studies are explained and how they correspond with the part 1 studies. First, although the perseverative cognition hypothesis states that worry can lead to somatic health complaints via prolonged physiological activity, as assumed in the study of chapter 3, an alternative pathway that bypasses the physiological route was suggested there and tested in a study reported in chapter 7. Somatic health complaints could be due to specific worries about one's health. It is possible that in people who frequently experience somatic health complaints bodily sensations trigger cognitive networks related to health, which promote selective cognitive processing and misinterpretations of these bodily sensations. In turn, highly accessible cognitive networks increase the likelihood of reporting somatic health complaints by causing worries about these complaints (Brown, 2004; Brosschot, 2002). To address this issue, we conducted a study in which we examined the extent to which common health complaints were associated with health worry, and with selective cognitive processing of health related information. Second, an implicit assumption in the studies using the worry postponement intervention (Brosschot and Van der Doef, 2006; chapter 5) or mindfulness based intervention aimed to reduce worry, is that worry episodes are prolonged due to difficulties in disengaging attention from threatening information. Indeed, recent work suggests that people who suffer from anxiety and dysphoria especially have trouble with *disengaging* attention from threatening information (Fox, Russo, Bowles, & Dutton, 2001; Fox, Russo, & Dutton, 2002; Goeleven, De Raedt, Baert, & Koster, 2006; Koster, Crombez, Verschuere, Van Damme, & Wiersema, 2006). In chapter 8, it was examined whether this was specifically due to heightened levels of worry. This would provide us with more clues on how to treat worry and provide evidence that interventions indeed do well by focusing especially on the engagement-disengagement dimension in the worry process. Third, concerning the cardiovascular effects of worry (chapter 6), it is not clear which elements of worry actually cause these cardiovascular effects. It might be that this is due to heightened levels of negative emotions, or it might be merely just 'thinking hard', that is, mental load

during cognitive problem solving. We therefore conducted a study in which heart rate (HR) and heart rate variability (HRV) were compared within subjects during induced worrying, problem solving concerning issues that were not personally relevant and relaxation (chapter 8). If mere mental load is responsible for - at least a part of - the physiological effects of worry, this might suggest that long term health effects of worry might be due to the prolonged mental load aspects of worry rather than to its emotional aspects, even though the latter is the most commonly held belief.

Figure 2 represents a more detailed model of how perseverative cognition is hypothesized to influence physiological and subjective health. Stressful events can lead to perseverative cognition, (operationalized as worry in the current thesis), as well as to negative affective responses and changes in information processing ('enhanced processing of threat'), of which the latter could be considered as an unconscious form of perseverative cognition. These three processes interact and enhance each other (chapters 2 and 8). Concerning the content of worry, worry is hypothesized to lead to somatic health complaints via both prolonged stress responses and via specific health worry (chapter 7). Furthermore, worry consists of mental effort and increases negative affect (anxiety), both of which are assumed to be associated with increased stress-related physiological activity (chapter 9).

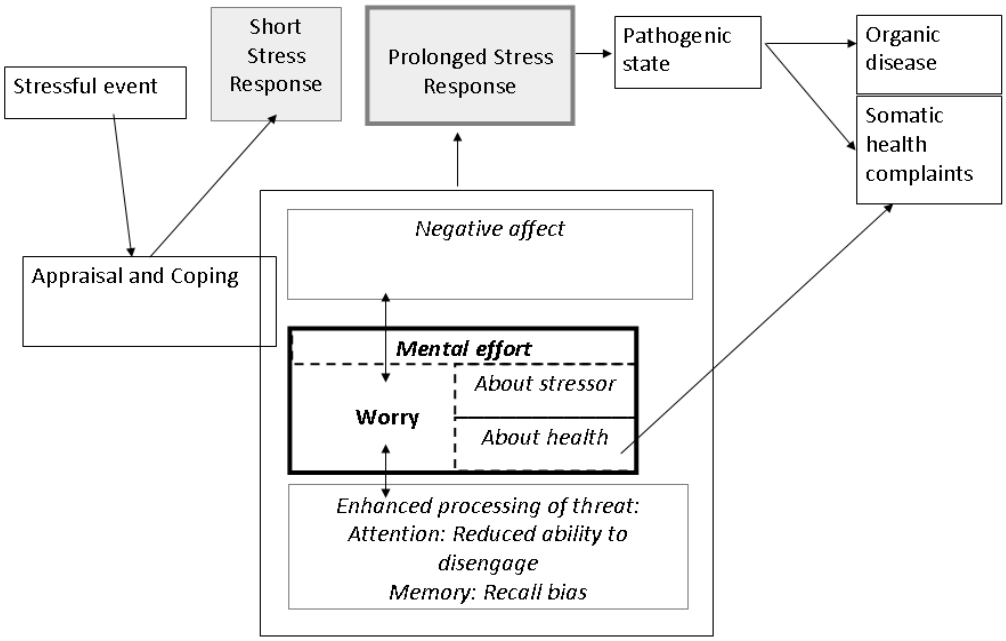


*Figure 2*. The extended perseverative cognition model.

Summarizing, the studies in this thesis are aimed at showing the effects of worry on several health outcomes, and attempt to address the mechanisms by which these effects are accomplished. These latter studies should be viewed as ‘first attempts’ and were meant to be hypothesis generating and inspiring future research rather than giving definite answers. Expanding knowledge on whether and how worry affects health might bring us a step further in disentangling how ‘stress’ can ultimately lead to ‘disease’.