

Repeated checking induces uncertainty about future threat

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Abstract

Studies have shown that obsessive-compulsive (OC) -like repeated checking paradoxically increases memory uncertainty. This study tested if checking also induces uncertainty about future threat by impairing the distinction between danger and safety cues. Participants ($n=54$) engaged in a simulated checking task, in which they completed two series of 19 checking trials. The experimental group checked burners on a stove and the control group checked light bulbs. Participants completed two pre-tests (before the first series of checks) and two post-tests (one after the first series of checks, the other after the second series). In these tests, they first checked the stove and answered questions about memory confidence and accuracy. Then one of two conditioned stimuli (CS; i.e., a circle) was presented. A CS+ replaced a burner that was on, and a CS- replaced a burner that had been switched off. During each CS presentation, participants rated their shock (UCS) expectancy and confidence about UCS occurrence. Next, the CS+ was followed by the UCS. Analyses showed that the first series of checks did not affect memory accuracy and UCS expectancy, but did reduce confidence about memory and about UCS occurrence in the experimental group, relative to the control group. The second series of checks did not lead to these group differences, compared to the first series. The results demonstrate that repeated checking increases uncertainty not only about memory, but also about future threat.

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Introduction

A core feature of obsessive-compulsive disorder (OCD) is persistent and debilitating doubt, often related to issues of overestimation of threat and inflated responsibility, which serves as a motive for compulsive behavior, such as counting in certain patterns or washing hands (Obsessive Compulsive Cognitions Working Group [OCCWG], 1997). The symptoms are alienating and time-consuming, and cause significant distress and/or disruption in social and occupational functioning (American Psychiatric Association, 2000). OCD has a lifetime prevalence of 2%, and the most common compulsion is checking, with a prevalence of around 80% (Ruscio, Stein, Chiu, & Kessler, 2010). Checking behavior is also common in the general population (Muris, Merckelbach, & Clavan, 1997). Most people will remember certain situations in which they felt responsible and double-checked (e.g., going back home to check whether the door is really locked). However, checking once or twice is not enough for patients with checking OCD. For them, checking is perseverative, and is repeated or continued without serving an apparent purpose (e.g., checking a door that is already locked) (Giele, van den Hout, Engelhard, Dek, & Klein Hofmeijer, 2011; Giele et al., 2013).

Studies have shown that checkers are less confident than healthy controls with respect to their memory performance (e.g., Constans, Foa, Franklin, & Mathews, 1995; McNally & Kohlbeck, 1993; Tolin et al., 2001). After checking repeatedly, patients remain relatively uncertain about their memory for checked events. Therefore, it has been suggested that checking might have paradoxical effects: Checking may not reduce, but increase memory uncertainty (e.g., Rachman, 2002). This has, indeed, been found (Boschen & Vuksanovic, 2007; Coles, Radomsky, & Horng, 2006; van den Hout & Kindt, 2003a, 2003b, 2004). In a first study by van den Hout and Kindt (2003a), healthy participants engaged in a checking task. In the first and the last trial, participants checked a virtual gas stove. In between these two checking trials, they checked the stove (relevant checking) or light bulbs (irrelevant checking) 18 times. After the first and last trial, questions about memory and meta-memory were assessed. Memory accuracy was similar for both groups, but vividness and detail of the memory as well as memory confidence had declined in the relevant checking group, but not in the irrelevant group. Research with a real instead of virtual stove (Radomsky,

Gilchrist, & Dussault, 2006), with threat-irrelevant abstract figures (Dek, van den Hout, Giele, & Engelhard, 2010), and with a clinical sample (Boschen & Vuksanovic, 2007) have resulted in similar findings. Moreover, changes in meta-memory have been observed after a relatively low number of checks; substantial reductions in memory confidence occurred between 2 and 10 checks (Coles et al., 2006).

In sum, while memory uncertainty provokes checking, repeated checking itself paradoxically increases uncertainty about memory for *past* actions ("what knobs did I check?"). Rachman (2002) suggested that patients feel urged to check, because they try to avoid being held responsible for future catastrophes. Studies have indicated that patients with OCD show a greater intolerance of uncertainty than non-clinical controls (e.g., Carleton et al., 2012; Steketee, Frost, & Cohen, 1998; Tolin, Abramowitz, Brigidi, & Foa, 2003). Intolerance of uncertainty is defined as the inability to tolerate the possibility that a relatively improbable negative event may occur, and typically relates to uncertainty about future catastrophes (Buhr & Dugas, 2002). For example, patients with OCD who are afraid of spreading disease may not shake hands before washing them repeatedly, and may be upset because they cannot rule out the possibility of future harm. It remains unclear if OC-perseveration also induces doubt about possible *future* threat. This question is important, because unpredictability of future threat is a causal factor in the development of anxiety disorders (Barlow, 2000). A large body of research has shown that organisms prefer predictable aversive events to unpredictable events (Badia, Harsh, & Abbott, 1979; Mineka & Kihlstrom, 1978) and unpredictable danger leads to a more sustained level of anxiety than predictable danger (Grillon, Baas, Lissek, Smith, & Milstein, 2004). Note that when threat can be predicted, then so can safety (i.e., when threat will not occur; Seligman & Binik, 1977). Therefore, unpredictable threat results in a state of chronic anxiety, because danger and safety cannot be distinguished. OCD is accompanied by "overly anticipating future threats" (Brüne, 2006). Does perseverative checking have paradoxical effects, not only by enhancing uncertainty about memory but also by enhancing uncertainty about future threats, making danger and safety less predictable?

In order to answer this question, we used a variation of a procedure that has been used in discriminative fear-conditioning paradigms (e.g., Lommen, Engelhard, Sijbrandij, van den Hout, & Hermans, 2013). Apart from learning that a conditional stimulus (CS) is a valid predictor of an unconditional positive or negative stimulus (UCS) (Davey, 1997; Engelhard, de Jong, van den Hout, & van Overveld, 2009; Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002), these paradigms include another stimulus (CS-) that is presented in the absence of the UCS. When a negative UCS is used in a conditional discrimination task, differential conditioning refers to the discrimination between the CS+ that predicts danger (e.g., shock) and the CS- that predicts safety (no shock or the absence of threat).

In this study, participants engaged in a checking task, and were randomly assigned to an experimental group (relevant checking; i.e., of a gas stove) or a control group (irrelevant checking; i.e., light bulbs). Before and after checking, participants checked the gas stove and answered questions about memory accuracy and confidence. Next, they were presented a CS+ or a CS- and rated their shock (UCS) expectancy and confidence about UCS occurrence. Just like earlier studies, we tested whether OC-like relevant checking decreases memory accuracy and confidence. Furthermore, we tested whether repeated relevant checking decreases UCS expectancy and confidence about UCS occurrence.

Method

Participants

Participants were 54 students (mean age = 23.07, $SD = 4.42$) from Utrecht University and Utrecht University of Applied Sciences. Exclusion criteria were: 1) a past or current diagnosed psychiatric disorder, 2) epilepsy, 3) a heart condition, 4) use of medication or a drug that may interfere with attention, reaction times, and/or memory, and 5) pregnancy. Students participated voluntarily and signed a written informed consent prior to participation. Afterwards, they received course credit or a financial compensation for participating.

Stimulus Materials

The task was based on the virtual checking task of van den Hout and Kindt (2003a), which has been used in a series of studies (e.g., Boschen & Vuksanovic, 2007, van den Hout & Kindt, 2003a, 2003b, 2004). It is a computer-based simulated checking task, in which a six-burner stove or a set of six light bulbs can be manipulated.

There were some differences between the current checking task and the original. First, the current task consisted of two series of 19 checking trials instead of one. Second, to ensure that the task did not take too long, manipulating the burners and light bulbs was simplified. The electric stove consisted of six rings with six corresponding knobs. Instead of moving the mouse cursor on a rotary knob, we used clicking on the knobs to turn the stove knobs on and off. A single burner was turned off by clicking three times on the corresponding knob with the left mouse key. After each click, the color of the burner changed from red (on) to white (off). By clicking the right mouse button three times, the burner was turned on. The six light bulbs were turned off and on by clicking three times on the corresponding sliding panels with the left or right mouse key. The color of the lights changed from yellow (on) to white (off) (see Figure 1). A third modification was that we added a differential conditional procedure to the checking task. After a checking trial, a CS was presented for 10s. It was a circle that replaced one of the six burners or light bulbs. It served as CS- when it replaced a burner/light bulb that was turned off, and as CS+ when it replaced a burner/light bulb that was *not* turned off.

After presenting the CS, a grey screen appeared for 5s. At the same time, the CS+ was always followed by a mild electric shock (UCS) for 5s, delivered via finger electrodes to two fingers of the non-dominant hand. It was adjusted individually to a level that was 'highly annoying but not painful' through a work-up procedure prior to the conditioning task (cf. Lommen et al., 2013; Orr et al., 2000). The CS- was never followed by the UCS.

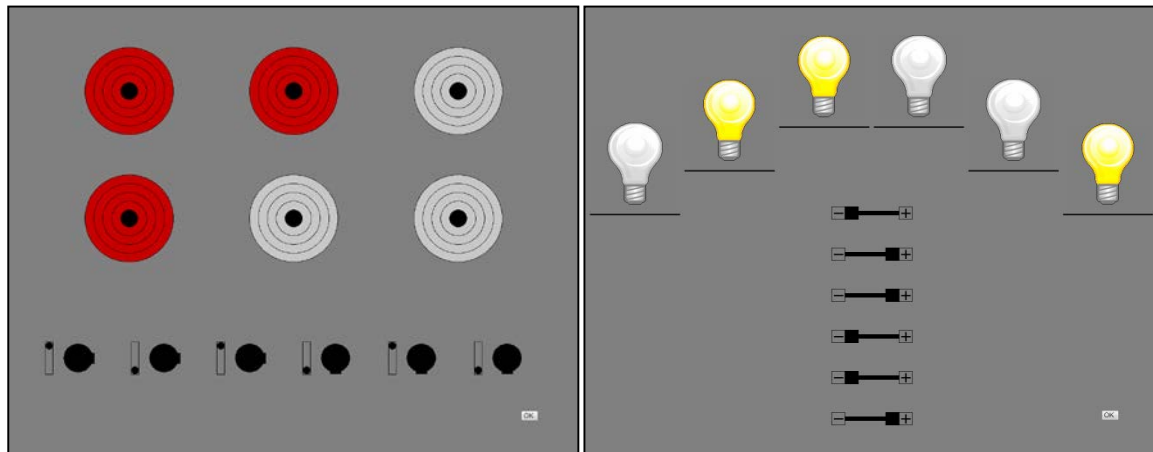


Figure 1: Computer animations of the electric stove and the light bulbs

Procedure

After checking the exclusion criteria, oral and written information was given and written informed consent was obtained. Next, the work-up procedure was used to determine the UCS level.

Practice and acquisition phase

First, participants were shown three crosses for 4s on the computer screen. Then, the electric stove appeared with six burners, of which three were located on the position of the former crosses. All six burners were on. Participants were instructed to turn off the burners that corresponded with the three crosses and click on the 'ok' button. Next, the stove was shown again and participants were instructed to check the three burners by turning them on and off. The same procedure was practiced with six light bulbs. Then the experimenter explained that after the next checking operation, a screen would be shown with a circle. This circle corresponded with one of the six burners or light bulbs that were shown in the former screen. It was made explicit to all participants that a circle over a burner which was previously 'on' was associated with shock, and a circle over a burner which was previously 'off' was associated with

no shock. Thus, only when the circle appeared on the place of a light bulb or burner which was *not* checked, it would be followed by the UCS. It was explicitly mentioned that the circle always concerned the last checking trial.

Next, participants received four practice trials: Two trials with the stove and two trials with light bulbs. One stove trial and one light bulb trial were followed by a CS+ and the UCS and the other two trials were followed by a CS-. Finally, participants practiced with three subsequent trials in which they checked light bulbs. The last trial was followed by a CS-. After the practice phase, the experimenter verified that participants understood the procedure and had learned the CS-UCS relationship.

Pre-tests

During the pre-tests, participants were administered two trials in which they checked the stove. After each trial, they completed a pre-test (see Assessments) which consisted of questions about memory accuracy and memory confidence (rated within 10s), and questions about UCS expectancy and confidence about this (also rated within 10s). When the CS+ was presented, it was followed by the UCS, and when the CS- was presented, it was followed by no UCS. Each participant was presented one CS- and one CS+ in random order.

Relevant vs. irrelevant checking

After the pre-tests, half of the participants were allocated to the relevant checking group, and the other half was allocated to the irrelevant¹ checking group. All completed a series of 19 trials; the relevant checking group checked the stove and the irrelevant checking group checked the light bulbs. After the 19th trial of the first and the second series of checks, both groups engaged in one checking trial with the stove and completed a post-test.

Post-tests

The post-tests were administered after the first and second series of 19 checks. The post-tests consisted of the same phases as the pre-tests. After checking the stove, participants completed questions about memory accuracy and memory confidence. Then, a CS+ or CS- was presented with questions about UCS expectancy and confidence about UCS occurrence. The CS+ was followed by the UCS. In one post-test a CS+ was presented and in the other post-test a CS- was presented. The order of the CS+ and CS- was randomized (see Figure 2).

¹ Checking light bulbs was considered 'irrelevant checking', because it was irrelevant to the stimulus (a stove) used in the pre-tests and post-tests.

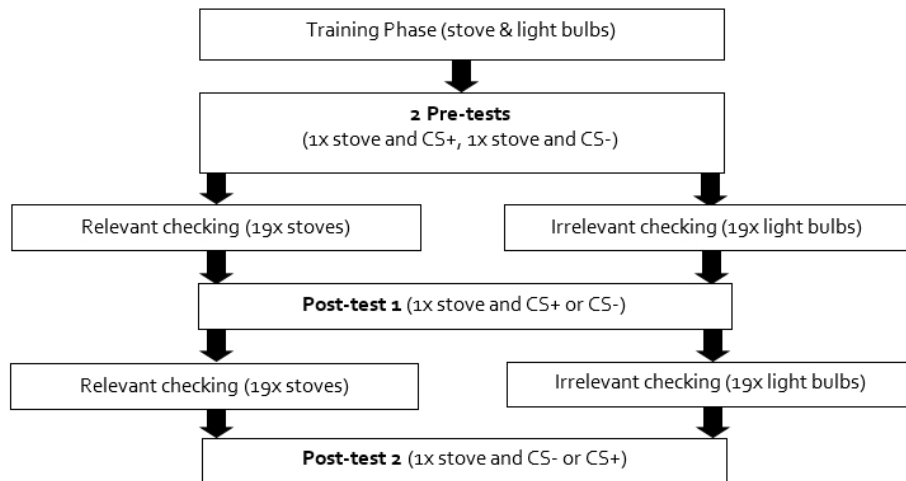


Figure 2: Design of the experiment

Assessments

Memory accuracy

Participants were shown a schematic representation of the six burners on the screen and were asked to click on the three circles representing the burners they had checked during the last checking episode.

Memory confidence

They were asked to indicate on a Visual Analogue Scale (VAS), ranging from 'absolutely not confident' (0) to 'absolutely confident' (100), how confident they were that their answer was correct.

UCS expectancy

Participants were asked to indicate whether the circle (CS) would be followed by the shock by clicking on 'yes' or 'no'.

Confidence about UCS occurrence

Confidence about the occurrence of the UCS was assessed by asking participants to indicate on a 100 mm VAS, ranging from 'absolutely not confident' (0) to 'absolutely confident' (100), how confident they were that their answer about UCS expectancy was correct.

Subjective aversiveness of the task

Afterwards, participants were asked to indicate on a VAS ranging from 'absolutely not unpleasant' (0) to 'very unpleasant' (100) how they found the task.

Results

Outliers (4.63% of the total responses) were changed to $M \pm 2.5 SD$. A mean pre-test score was calculated for each participant.

Memory accuracy

In total, 12 mistakes (5.56%) were made at the pre- and post-tests. The number of mistakes in the relevant and irrelevant checking group decreased from pre- to post-tests (see Table 1). Thus, memory *accuracy* was not reduced by repeated checking.

Table 1: Number of mistakes made in memory accuracy at pre-tests, post-test 1 and post-test 2

	Pre-tests	Post-test 1	Post-test 2
Relevant checking group	6	1	0
Irrelevant checking group	2	3	0

Memory confidence

Three participants were excluded from the analysis on memory confidence, because they did not respond within time on the first post-test ($n = 1$) or the second post-test ($n = 2$). This resulted in a sample of 51 participants. Since the assumption of sphericity was violated, $\chi^2(2) = 8.26$, $p < .05$, Greenhouse-Geisser corrected values were used. A repeated measures analysis with Group (Relevant vs. Irrelevant checking) as between-groups variable and Time (pre-test vs. post-test 1 vs. post-test 2) as within-subjects variable was performed to assess the effect of repeated relevant checking on memory confidence. This 3×2 ANOVA revealed no significant main effects for Time, $F(1.73, 84.62) = 1.80$, $p = .18$, $\eta_p^2 = .04$, or Group, $F(1,49) = 2.97$, $p = .09$, $\eta_p^2 = .06$. The crucial Time by Condition interaction was significant, $F(1.73, 84.62) = 5.54$, $p = .008$, $\eta_p^2 = .1$, reflecting that the effect of repeated checking on memory confidence differed between conditions (see Figure 3).

Simple main effects analyses showed a decrease in memory confidence from the pre-test to post-test 1 in the relevant checking condition, $M_{diff} = 12.75$, $p = .001$, but no change in the irrelevant checking condition, $M_{diff} = 5.1$, $p = .15$. The pre-test to post-test 2 difference in memory confidence was also significant in the relevant checking condition, $M_{diff} = 8.35$, $p = .016$, and was not significant for the irrelevant checking condition, $M_{diff} = 1.41$, $p = .67$. The post-test 1 to post-test 2 differences in memory confidence were not significant for the relevant checking condition, $M_{diff} = 4.40$, $p = .34$, and the irrelevant checking condition, $M_{diff} = 6.51$, $p = .15$.

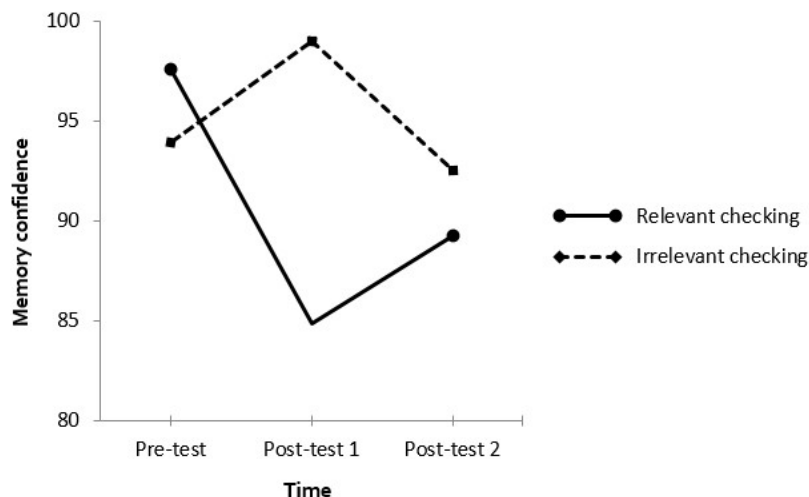


Figure 3: Memory confidence before and after relevant/irrelevant checking

UCS expectancy

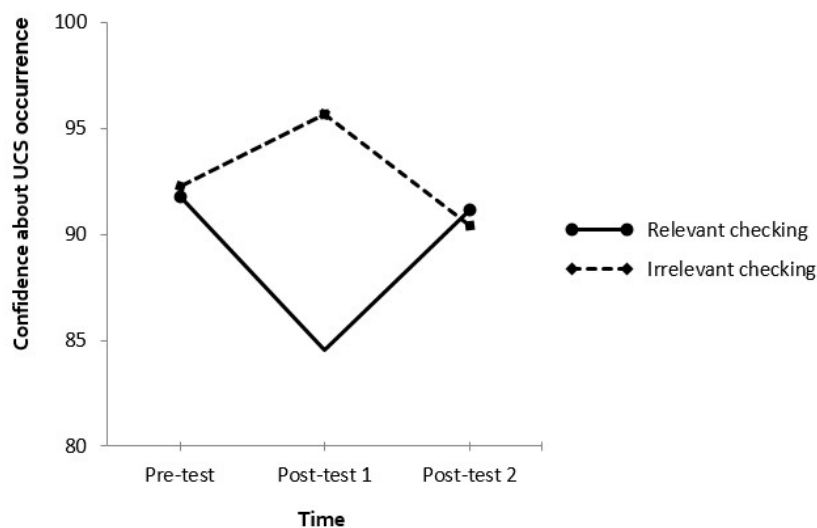
There were four missing values (1.85%) and 23 mistakes (10.65%) during the pre- and post-tests. Table 2 gives the number of mistakes (i.e., prediction errors) in both conditions at pre-tests and post-tests. Furthermore, participants learned to discriminate the CS+ and CS-. That is, participants expected the UCS in 84.0% of the CS+ trials (of the pre-tests and post-tests), and 5.7 % of the CS- trials. This difference was significant, $\chi^2(1) = 128.25$, $p < 0.001$.

Table 2: Number of mistakes (i.e. prediction errors) in UCS expectancy at pre-tests, post-test 1 and post-test 2

	Pre-tests	Post-test 1	Post-test 2
Relevant checking group (n = 26)	1 (and 2 missing values)	4	1
Irrelevant checking group (n = 28)	10 (and 2 missing values)	3	4

Confidence about UCS occurrence

Two participants did not respond within the set time on both pre-tests, therefore they were excluded from analysis. This resulted in a sample of 52 participants. A 3 x 2 ANOVA was conducted with Time (pre-test vs. post-test 1 vs. post-test 2) as within-subjects factor and Group (Relevant vs. Irrelevant checking) as between-subjects factor and confidence in UCS occurrence as dependent variable. Main effects of Time, $F(2,100) < 1$, $p = .71$, $\eta_p^2 = .007$, and Group, $F(1,50) = 1.14$, $p = .29$, $\eta_p^2 = .02$, were not significant. In line with our predictions, there was a significant Time x Group interaction, $F(2,100) = 3.99$, $p = .022$, $\eta_p^2 = .07$ (Figure 4), indicating that changes in confidence about UCS occurrence differed between the groups. Subsequent simple main effects analysis showed that confidence about UCS occurrence decreased in the relevant checking group from pre-test to post-test 1, $M_{diff} = 7.19$, $p = .018$, but not in the irrelevant checking group, $M_{diff} = 3.41$, $p = .24$. The pre-test to post-test 2 differences in confidence were not significant for the relevant checking condition, $M_{diff} = .59$, $p = .86$, and irrelevant checking condition, $M_{diff} = 1.85$, $p = .57$. Although Figure 4 suggests that confidence about UCS occurrence increased in the relevant checking group from posttest 1 to posttest 2, this effect was not significant, $M_{diff} = 6.6$, $p = .075$. For the irrelevant checking group, the posttest 1 to post-test 2 change was also not significant, $M_{diff} = 5.26$, $p = .14$.

**Figure 4: Confidence about UCS occurrence before and after relevant/irrelevant checking**

Subjective aversiveness of the task

Scores on subjective aversiveness of the relevant checking group, $n = 26$, $M = 43.32$, $SD = 29.93$, did not differ from the irrelevant checking group, $n = 28$, $M = 43.97$, $SD = 23.58$, $t(47.51) = .09$, $p = .93$, $d = 0.02$, 95% CI [-14.17, 15.48].

Discussion

Several studies have shown that repeated checking induces uncertainty about past events ("which knobs did I check?"). The present study is the first to examine whether checking also induces uncertainty about *future* threat. Participants learned that a CS+ (circle presented on the place of a burner which was turned on) predicted danger

(shock) and that a CS- (circle presented on the place of a burner which was off) predicted safety (no shock). We tested whether repeated checking induced uncertainty about CS+/CS- discriminations, making future safety and danger less predictable.

The results replicate and extend the earlier findings. Although modifications were made to the original checking task used in earlier research (e.g., Boschen & Vuksanovic, 2007; van den Hout & Kindt, 2003a, 2003b, 2004), similar results were obtained: After one series of 20 checks, repeated relevant checking decreased confidence in memory, but did not affect memory accuracy. There was no further decrease in memory confidence after a new series of 20 checks. Coles et al. (2006) demonstrated that memory uncertainty increased when the number of checks increased: Participants completed 0, 2, 5, 10, or 15 checks. The most substantial reductions in memory characteristics occurred after a relatively low number of checking trials; memory confidence was increasingly affected between 2 and 10 checks. The decrease in memory confidence did not differ between the 10 and 15 check conditions. In the current study, participants engaged in a relatively high number of checks. Therefore, the decrease in memory confidence after the second series of checks might be subject to a floor effect.

Furthermore, two series of 20 checks do not equal 40 consecutive checks. Van den Hout and Kindt (2003a) have suggested that repeated checking increases familiarity with the checked event and leads to a shift from perceptual to conceptual processing, which results in reduced vividness and detail of the person's recollection of the stimulus, thereby reducing memory confidence. Interestingly, this effect of repeated checking on memory confidence can be attenuated by the use of novel and/or distinctive stimuli, which increase perceptual processing (Boschen, Wilson, & Farrell, 2011). Although we did not change the checked stimulus after the first 20 checks, the automatic processing of the checked stimulus was disrupted by a post-test with new perceptual elements. Therefore, it is possible that participants started with a small increase in perceptual processing at the beginning of the second series of 20 checks. This explanation does not seem to relate well to the phenomena of OCD, because in real life, checking rituals encompass the succession of discrete checking episodes. This (small) disruptive effect of the second post-test on memory confidence would probably not be present anymore after a third post-test with a new checking episode.

Apart from inducing memory uncertainty and relative to the control condition that checked irrelevant, repeated relevant checking decreased confidence about future threat. After 20 checks, participants were less confident whether or not a CS would be followed by a mild shock (UCS). Just like repeated checking did not affect memory accuracy, the ability to predict the UCS correctly also remained unaffected by relevant checking. The findings with respect to the second series of 20 checks remained somewhat ambiguous. Confidence about UCS occurrence between the first post-test and the second seemed to increase, although this change was non-significant. There was also no difference in confidence about UCS occurrence between the pre-test and the second post-test. This might be related to the experimental design. After the first series of checks, the post-test was not expected by participants. However, the occurrence of this first post-test may have prepared participants for a new test at the end of the second series, possibly motivating them to remain better focused.

There were no differences between the relevant checking group and the irrelevant checking group with respect to their ratings of subjective aversiveness of the task. This is somewhat surprising, given that unpredictable aversive events are generally more frightening than predictable aversive events (Grillon et al., 2004). However, the aversiveness of the procedure was mainly derived from the occurrence of the shocks, which was identical in the two conditions. This may have obscured any more subtle effects of unpredictability.

The results of the current study demonstrate that repeated checking not only increases uncertainty about memory, but also increases uncertainty about future threat. Patients with OCD try to obtain certainty about the possibility of future aversive events. Repeated checking seems to be counterproductive, because their confidence in the prediction of those threats is reduced by this behavior. As unpredictable danger increases anxiety (Grillon et al., 2004, this may contribute to the maintenance of the disorder.

Although theoretically relevant, the experimental design that is used in the current study differs somewhat from everyday checking by OCD patients. The first difference relates to the actual exposure to the threat. In the current experiment, a small number of harmless electric shocks were given to the participants to be certain that they learned the CS-UCS association. However, patients with OCD (usually) do not experience their feared threat. In future studies, it would be interesting to investigate if the same effect might be obtained with an UCS that has not been

presented before. Second, another difference is the disconnection between the checking activity (e.g., checking a gas stove) and threat (shock). The UCS that we used symbolizes the catastrophes that are feared by patients (e.g., fire). However, future studies may examine if the effects of repeated checking are enhanced when the UCS is idiosyncratic for OCD patients and ecologically connected to the checked event (i.e., fire due to not checking the stove properly).

The third difference relates to the way in which the stimuli were checked. Although checking virtual burners on a screen is not the same as real life checking, the stimuli (i.e., burners and light bulbs) that are checked in the current study are stimuli that are also checked by (some) OCD patients in their daily lives. However, in the current study, every trial, participants checked three different burners (out of six). Moreover, participants turned those burners completely on and off. At first glance, this procedure clearly differs from the checking ritual of OCD patients. Patients may remain focused on the same stimuli to make sure that they are really turned off, closed, switched off, etc. However, some patients report that they are unsure as a result of their repeated checking operations ("maybe I touched the other knobs with my sleeve during the last checking episode"). As a result, they may engage in different types of checking (e.g., checking burners/ lights that were not checked before by turning them on and off). Just like the current study, these different checks may result in different memory recollections.

The hypotheses that were tested imply that uncertainty about memory for past action and future events are normal results of repeated checking. Therefore, the predictions were tested in samples of healthy individuals. Boschén and Vuksanovic (2007) reported that decreases in memory confidence after repeated checking were equal for OCD patients and healthy controls. It remains to be demonstrated whether or not uncertainty about future threat after repeated checking would also be observed in OCD patients. Although this is still an open issue, there are no indications that such differences between OCD patients and controls exist.

In sum, the current study replicates previous work demonstrating that repeated checking increases uncertainty about the cognitive operations involved (e.g., memory for checked events). In addition, it demonstrates that checking behavior also induces uncertainty about future threat: checking undermines confidence in the ability to discriminate future safety from impending threat. It seems unlikely that repeated checking leads to reduced confidence in general. For example, Dek et al. (2010) found that repeated checking reduced confidence in memory, but not in perception or attention. Therefore, reduced confidence in memory and about future threat do not seem secondary to reduced confidence in general.

Note that the aversive shock was administered if a circle (CS) replaced a burner that not turned off in the last trial. The shock was not administered if the circle replaced a burner that was turned off. Participants had to remember whether the burner was turned off or not in order to estimate whether the circle would be followed by a shock. Thus, it is highly plausible that the reduced confidence in UCS expectancy was due to reduced memory confidence induced by repetition. However, crucial to the present findings is that under specific conditions, like the ones created here, reduced memory confidence serves to reduce confidence in the prediction of future events.

Patients with OCD engage in perseverative safety behaviors, like checking, to prevent harm from occurring (Rachman, 2002). When repeated checking increases anxiety by making future danger less predictable, this could increase these safety behaviors. OCD patients may then be trapped in a vicious circle, with repeated checking fuelling problems in telling safety from threat and the other way round. Radomsky, Shafran, Coughtrey and Rachman (2010) and Shafran, Radomsky, Coughtrey and Rachman (2013) suggest to incorporate experimental studies on repeated checking into treatment methods, for example, by using behavioral experiments that let patients experience that repeated checking causes uncertainty. The present findings may serve to underscore why abstaining from perseveration is a crucial element in exposure and response prevention (ERP), the treatment of choice for OCD (Clark, 2004; Rosa-Alcázar, Sánchez-Meca, Gómez-Conesa, & Marín-Martínez, 2008).

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