Paradoxical effects of compulsive perseveration: Sentence repetition causes semantic uncertainty

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ABSTRACT

Many patients with obsessive compulsive disorder (OCD) perform perseverative checking behavior to reduce uncertainty, but studies have shown that this ironically increases uncertainty. Some patients also tend to perseveratively repeat sentences. The aim of this study was to examine whether sentence repetitions leads to semantic uncertainty and how fast this effect occurs. We also explored if effects of repeating sentences are affected by simultaneously looking at the primary object in the repeated sentence (e.g., looking at a mug while saying "the mug is clean"). Between a pre- and post-test, 165 students repeated short sentences only once (control conditions), or 5, 10 or 20 times (experimental conditions). In the pre- and post-test, they completed a questionnaire about feelings of uncertainty and dissociation. While repeating the sentence, participants looked at the object that was part of their perseveration (relevant) or looked at a white wall (irrelevant). Results showed that sentence repetition induces semantic uncertainty, which increased with more sentence repetitions, and was the largest after 20 repetitions. This effect was not qualified by looking at the object of perseveration. These and earlier findings suggest different types of OC-like perseveration have detrimental effects and may fruitfully be targeted in psychological treatments of OCD.

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1. Introduction

A core feature of obsessive compulsive disorder (OCD) is a persistent and debilitating doubt. This motivates checking to increase certainty, like checking that the iron is unplugged. Compulsions are typically 'perseverative': checking may go on for minutes or even hours, beyond the point where the goal of the action is reasonably reached (Giele et al., 2013). Paradoxically, repeated checking itself produces memory uncertainty. For instance, van den Hout and Kindt (2003a, 2003b, 2004) instructed healthy participants to engage in an OC-like checking task that involved repeatedly checking a virtual gas stove. After this perseverative checking, memory accuracy remained intact, but the recollections were less vivid and detailed than a control group and, most importantly, memory confidence had declined. Checking behavior seems to be self-perpetuating: it leads to reduced memory confidence, which in turn motivates more checking (Rachman, 2002). These negative effects of compulsive checking on memory certainty have been replicated with a real gas stove (Radomsky, Gilchrist, & Dussault, 2006; Ashbaugh & Radomsky, 2007), threat-irrelevant stimuli (Dek, van den Hout, Giele, & Engelhard, 2010), and patients with OCD (Boschen & Vuksanovic, 2007).

Nevertheless, the lack of confidence in patients with OCD is not restricted to memory; it also occurs in other cognitive areas, like perception. Patients may visually fixate on an object, and, for

example, stare at their hands to determine if they are really clean, or at a light-knob to convince themselves that the light is really off. Healthy participants who stared for 10 min at a gas stove reported uncertainty about their perception (van den Hout, Engelhard, de Boer, du Bois, & Dek, 2008), and the time-effect of visual perseveration is fast—increased uncertainty was already found after 15 s of staring (van den Hout et al., 2009).

Reasoning may have perseverative features as well. When some patients with OCD find themselves in disorder-relevant situations, they tend to reason in chains of small steps between the current situation and a highly improbable catastrophe, apparently to make sure they do not overlook potential harmful events. Yet research among healthy participants has shown that OC-like step-by-step reasoning from a neutral situation to a catastrophic outcome enhances the credibility of this feared outcome (Giele, van den Hout, Engelhard, Dek, & Klein Hofmeijer, 2011). Note that a very similar phenomenon was documented by O'Connor and Robillard (1995), who described an 'inferential confusion' between reality and possibility in patients with OCD. It has been suggested that this is due to a reasoning process in which OCD patients treat obsessions as valid probabilities rather than recognizing the obsession as an imagined possibility (e.g., Aardema, O'Connor, Emmelkamp, Marchand, & Todorov, 2005).

Thus, OC perseveration appears to paradoxically promote uncertainty, and this has been found so far with respect to checking and staring. Moreover, reasoning leads to similar paradoxical effects by increasing the credibility of feared catastrophes. Some OCD patients tend to perseveratively repeat sentences ("my hands are clean, my

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hands are clean" etc). The question ensues whether text repetition also induces uncertainty. Repeating sentences may lead to brief feelings of ambivalence about the meaning of these sentences to the person, a phenomenon called 'semantic satiation' (Pynte, 1991). The spreading of activation theory states that when a person is presented with a stimulus, the concepts most closely connected to that stimulus are activated as well and become more accessible (Collins & Loftus, 1975). This is thought to occur very fast and without awareness (Dehaene et al. 1998), and to contribute to the experience of the meaning of the word. The spreading of activation theory has typically been studied in semantic priming studies. Meyer and Schvaneveldt (1971) presented two strings of letters simultaneously on a computer screen. Participants were instructed to decide as quickly as possible whether the strings were words or non-words. They were faster for pairs of semantically-associated words (e.g., 'bread' and 'butter') than for pairs of unassociated words ('bread' and 'doctor'). However, when a word is repeatedly presented, it appears that the spreading of activation to related words is blocked (Pynte, 1991; Sanbonmatsu, Posavac, Vanous, Ho, & Fazio, 2007; Smith, 1984). For example, Smith (1984) instructed participants to repeat the name of a category 3 or 30 times, and then decide as fast as possible whether or not a target exemplar belonged to the repeated category. This decision was slower after 30 compared to 3 repetitions. It is presumed that this is the underlying mechanism of semantic satiation; when a word is repeatedly presented, the accessibility of semantically-related words is disrupted. This satiation effect can be experienced subjectively; after repeating the word 'bread' several times, the word does not completely lose meaning to the person, but starts to sound strange and induces feelings of ambivalence ("I know what it means, but it sounds strange"). Yet, to our knowledge, this subjective semantic ambiguity has never been tested experimentally.

Patients with OCD typically repeat sentences and not words. Therefore, the aim of the current study was to test whether sentence repetition leads to subjective semantic uncertainty about the meaning of the sentence. Note that patients often look at the object of interest (e.g., a light switch) when they repeat sentences (e.g., "the light is off, the light is off"). We explored whether the hypothesized effect of sentence repetition on semantic uncertainty is affected by simultaneous looking at the object of perseveration. Since limited amounts of checking and short durations of staring are sufficient to create uncertainty (Coles, Radomsky, & Horng, 2006; van den Hout et al., 2009), we also decided to examine the threshold at which repeating sentences induces uncertainty.

The current study and the majority of the studies that are described are carried out with a non-clinical sample. This is important, as it is hypothesized that perseverative behavior itself serves to increase uncertainty. This implies that when healthy participants engage in OC-like perseveration, they should experience the same type of uncertainty that is experienced by OCD patients.

In sum, the aim of this study was to test if repeating short sentences leads to subjective semantic uncertainty. It was predicted that (a) compared to a control group, sentence repetition increases semantic uncertainty and (b) there is a dose response relationship between semantic uncertainty and number of repetitions. Furthermore, we explored if effects of repeating sentences are affected by simultaneously looking at the object of interest (e.g., looking at a mug while saying "the mug is clean").

2. Method

2.1. Participants

Participants were 165 volunteer undergraduate students from Utrecht University and University of Applied Sciences (103 females; mean age=21.8 years,

$SD=2.15$). They received course credit or a small financial remuneration for their participation.

2.2. Design

The experiment had a $2 \times 4 \times 2$ mixed factorial design. The within-group factor was Time: participants completed a questionnaire during a pre-test and a post-test. The first between-group factor was Number: between the pre-test and post-test, participants were asked to say a sentence once (control conditions), or repeat it for 5, 10 or 20 times (experimental conditions). These numbers were based on results of pilot studies. The second between-group factor was Looking: during perseveration, attention was focused on the object of perseveration (a series of books or a mug) or a white wall.

2.3. Procedure

Participants were tested in a dimly lit and sound-attenuated room. The distance between the participant's chair and object of perseveration or the white wall was 50 cm. Participants were asked not to move their chair during repetition of the sentence. The experimenter sat behind the participant. Before the experiment started, participants practiced with repeating sentences aloud at the same pace.

First, participants listened to a sound fragment played on the computer, in which a sentence was prompted. They were instructed to recite the sentence and to look at the object of perseveration that was either a row of books or a mug. Half of the participants said aloud "the mug is clean" and looked at a clean white mug. The other half said "the books are standing up straight" and looked at a straight row of four books.

Then, in the pre-test, they completed a questionnaire (see below) on the computer. Next, participants in the 20 repetitions conditions performed the sentence repetitions task, participants in the other six conditions started with a filler task on the computer in which they were asked to detect vowels as quickly as possible. The duration of this task was 28.5 s in the control conditions, 22.5 s in the 5 repetitions conditions and 15 s in the 10 repetitions conditions. After the filler task, participants heard the sound fragment again and said the sentence once or 5, 10 or 20 times, depending on the condition. While perseverating, half of the participants looked at the same object as before the pre-test (mug or books) and the other half looked at the white wall (and could not see the object). Instructions stressed the importance of concentrating on the object or white wall without talking or looking away. Finally, during the post-test, participants completed the same questionnaire as in the pre-test. While completing the questionnaire, the object was covered with a cloth.

2.4. Measures

2.4.1. Semantic uncertainty

The level of semantic uncertainty was measured with the following four items that were scored on 100 mm Visual Analogue Scales (VAS), ranging from 'never' (uncertain, meaningless, unreal or strange) to 'always'. The first two semantic uncertainty items used in the present study were generated by the authors and based on pilot studies. The last two items were based on earlier research that examined other forms of perseveration (van den Hout et al., 2008, 2009; Giele et al., 2013).

- While saying the sentence, I was uncertain about its meaning.
- While saying the sentence, it seemed as if it did not really have a meaning.
- While saying the sentence, it sounded unreal.
- While saying the sentence, I thought it sounded strange.

Cronbach's alpha was .73 at the pre-test and .82 at the post-test, which indicates that the four items tap the same construct. Corrected item-total correlations at both times were $> .3$. The final score was the average of the four items (range=0–100).

3. Results

Outliers were changed into $M \pm 2.5SD$. When the direction of the differences was predicted, one-tailed *p* values are reported.

3.1. OCI-R

After the experimental tasks, participants completed the obsessive–compulsive inventory-revised (OCI-R), which is a self-report measures of obsessive compulsive features (Foa et al. 2002), and has good psychometric properties (Abramowitz & Deacon, 2006; Huppert et al. 2007). The mean OCI-R score was 12.6 ($SD=8.2$),