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Perseveration induces dissociative uncertainty in obsessive–compulsive disorder



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ABSTRACT

Background and objectives: Obsessive compulsive (OC)-like perseveration paradoxically increases feelings of uncertainty. We studied whether the underlying mechanism between perseveration and uncertainty is a reduced accessibility of meaning ('semantic satiation').

Methods: OCD patients ($n = 24$) and matched non-clinical controls ($n = 24$) repeated words 2 (non-perseveration) or 20 times (perseveration). They decided whether this word was related to another target word. Speed of relatedness judgments and feelings of dissociative uncertainty were measured. The effects of real-life perseveration on dissociative uncertainty were tested in a smaller subsample of the OCD group ($n = 9$).

Results: Speed of relatedness judgments was not affected by perseveration. However, both groups reported more dissociative uncertainty after perseveration compared to non-perseveration, which was higher in OCD patients. Patients reported more dissociative uncertainty after 'clinical' perseveration compared to non-perseveration.

Limitations: Both parts of this study are limited by some methodological issues and a small sample size.

Conclusions: Although the mechanism behind 'perseveration → uncertainty' is still unclear, results suggest that the effects of perseveration are counterproductive.

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1. Perseveration induces dissociative uncertainty in obsessive–compulsive disorder

Most patients with Obsessive–compulsive disorder (OCD) carry out compulsive behaviors, which may be motivated by the wish to reduce uncertainty (Rachman, 2002). These compulsions are typically perseverative, that is, they are recurred or prolonged beyond the point where the goal of this action is reasonably reached (Giele, van den Hout, Engelhard, Dek, & Klein Hofmeijer, 2011). It has been argued that these compulsions have the opposite effect, and that, paradoxically, OCD perseveration increases uncertainty.

This has been demonstrated in several studies. When students were instructed to repeatedly check a gas stove, their confidence in memory, as well as memory vividness and detail declined compared to a control group. Perseverative checking had no effect

on memory accuracy (van den Hout & Kindt, 2003a; 2003b; 2004). Other forms of perseverative behavior (e.g., staring or washing) have the same paradoxical effects as repeated checking. Prolonged, visually fixating on objects induces uncertainty about perception (van den Hout, Engelhard, de Boer, du Bois, & Dek, 2008; van den Hout et al., 2009), repeated OC-like washing increases uncertainty about contamination (Deacon & Maack, 2008), repeating sentences induces uncertainty about their meaning (Giele, van den Hout, Engelhard, & Dek, 2014) and perseverative reasoning towards an obsessive–compulsive (OC)-like catastrophe increases the probability of this feared outcome (Giele et al., 2011). The results of these studies suggest that the effects of perseveration are domain specific, only the cognitive processes that are subject to perseveration are affected. This might be special cases of a more general principle; that is, perseveration may lead to uncertainty about the cognitive operation that is involved (Giele et al., 2013). Thus, perseverative behavior does not have the desired effect of reducing uncertainty, but, on the contrary, backfires and increases doubt. This may result in a vicious circle of perseverative behavior and

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uncertainty. This implies that perseveration may be a counter-productive strategy, which may serve to maintain the disorder.

The uncertainty that is experienced after perseveration has a distinct dissociative character ('I remember doing it in a way, but it's all fuzzy', Reed, 1985). Individuals understand the nature of the perceived stimulus, but report that it feels strange and unreal. Interestingly, these dissociative experiences after perseveration were also found in non-clinical participants (Giele et al., 2014; van den Hout & Kindt, 2003b; expt. 4, Hout et al., 2008; 2009). Why does perseverative behavior induce uncertainty, and why is this uncertainty dissociative? Derealization during perseveration represents a disturbance in perception of *meaning*. This phenomenon is reminiscent of findings on spreading of activation and semantic satiation.

The spreading of activation theory proposes that when a person is presented with a concept, this will prime concepts semantically related to it, which means that their retrieval will be more rapid than the retrieval of unrelated concepts (Collins & Loftus, 1975). Studies indicated that relatedness decisions of participants are faster when a prime and target are semantically related than when they are semantically unrelated (Neely, 1976). However, when a word is *repeatedly* said out loud (e.g., 'bread, bread, bread'), its meaning is affected and facilitation of recognizing related words decreases (Pynte, 1991). According to the semantic satiation hypothesis, as a function of repetition, there is a 'fatigue' of underlying mental structures resulting in semantically-related concepts becoming less accessible (Pynte, 1991; Sanbonmatsu, Posavac, Vanous, Ho, & Fazio, 2007; Smith, 1984; Smith & Klein, 1990). Smith (1984) demonstrated this with a category membership task in which participants repeated a prime word (e.g., fruit) 3 or 30 times and had to decide whether a target word (e.g., apple) belonged to the same category. When the target was a member of the repeated category (e.g., apple – fruit), decision times increased after 30 repetitions, whereas no effect was observed with non-member targets. Hence, after repetition, 'fruit' lost the power to serve as a prime for related words (Smith, 1984; Smith & Klein, 1990). Lewis and Ellis (2000) replicated these results with visual representations.

Thus, perseveration of words and images blocks spreading of activation. The experience that a word feels strange after repetition (e.g., "milk, milk, milk") seems to be comparable to the dissociative feelings that patients report after repeated checking or staring. The word will not completely lose its meaning; on a general level the meaning of the word is still understood. However, it starts to sound odd and unreal. Patients know what they are checking, but experience that it feels strange and unreal (van den Hout & Kindt, 2003b; Reed, 1985). If repeated checking also blocks spreading of activation of semantically related concepts, then this may explain how OC-like perseveration breeds dissociative uncertainty. Normally, a perceived stimulus activates related concepts and derives its meaning from this context. For example, when someone turns on the light with a light switch, related concepts like a light bulb will become more accessible. Moreover, the person knows that this switch is a light switch because this is confirmed by the context (e.g., when the position is changed, the light bulb produces light). Possibly, repeatedly checking a light switch may block spreading of activation to semantic related concepts, like a lamp, and thereby reduces access to those related concepts and affect meaning of that behavior. And when the meaning of checking a light switch is less accessible, this may result in a dissociative experience of uncertainty (e.g., "I know that the switch is off, but it feels fuzzy and unreal").

To examine the relevance of 'blocked spreading of activation' induced by repetition to the understanding of OCD, Giele et al. (2013) used a relatedness decision task to test whether there

were satiation effects after executing perseverative *motor behavior*. Healthy participants exhibited 20 types of OC-checking behaviors. After 2 or 20 repetitions of the same check-operation, they heard a tone and were shown a picture. Participants said as quickly as possible whether this picture was semantically related (e.g., a coffee cup) or unrelated (e.g., a pencil) to the check-operation (e.g., checking a coffee machine). After 2 repetitions, participants were faster in their relatedness decisions when the picture and checked object were related than when they were unrelated. This spreading of activation effect was blocked after 20 repetitions: participants' responses to related and unrelated pictures were equally fast. Moreover, participants who perseverated 20 times scored significantly higher on dissociative uncertainty than participants who repeated the act twice (Giele et al., 2013).

The results of the study described above suggest that the ironic effects of compulsive perseveration are due to interference with spreading of activation. Carrying out compulsive perseveration slowed down relatedness judgments, which suggests that access to the meaning of related stimuli was reduced. This may induce the dissociative doubt that is experienced by OCD patients. Compared to non-clinical controls, OCD patients report more dissociative experiences (Goff, Olin, Jenike, Baer, & Buttolph, 1992), and the question arises whether patients with OCD, compared to healthy controls are more sensitive to the 'perseveration → satiation' effect described above. The current study aimed to answer this question, and consisted of two parts.

2. Part 1

The goal of the first study was to add to the existing literature by investigating whether the maintenance of dissociative uncertainty by perseveration could be explained through semantic satiation. It aimed to critically test whether the 'perseveration → uncertainty' phenomenon can be explained in terms of a blocked spreading of activation of related concepts. OCD patients and matched controls participated in a perseveration task that was comparable to the described experiment with healthy controls (Giele et al., 2013). We hypothesized that (1) in both the OCD group and a matched non-clinical control group, relatedness judgments would slow down and (2) dissociative uncertainty would be higher in the perseverative condition, compared to the non-perseverative condition. Furthermore, we hypothesized that the impact of perseveration for OCD patients compared to non-clinical controls would be higher (3) on reaction times and (4) subjective ratings of dissociative uncertainty. Constans, Foa, Franklin, and Mathews (1995) reported that OCD patients and controls did not differ in the level of reported vividness of memories, but OCD patients stated that they desired more vivid memories than controls. This discrepancy between actual and desired quality of memory suggests an intolerance of uncertainty. Several studies have found indications that OCD patients indeed experience more intolerance of uncertainty than non-clinical controls (e.g., Steketee, Frost, & Cohen, 1998). For example, a study by Tolin, Abramowitz, Brigidi, and Foa (2003) revealed that OC checkers showed greater intolerance of uncertainty than OC non-checkers or non-anxious controls. Therefore, we also explored whether, (5) regardless of perseveration, the dissociative uncertainty caused by perseveration was tolerated less by OCD patients compared to non-clinical controls.

3. Method

3.1. Participants

OCD patients were recruited from the Altrecht Academic Anxiety centre (AAA) mental health centre (ambulant care) and the

Vincent van Gogh Centrum Angst-en Dwangstoornissen (VVG-CAD) mental health centre (inpatient care). Patients were assessed the OCD module of the Dutch version (van Groenestijn, Akkerhuis, Kupka, Schneider, & Nolen, 1999) of the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996) and were included when they had a DSM-IV diagnosis of OCD. This OCD module was administered by a psychologist under the supervision of the first author. Two patients were excluded from analysis because they were in partial remission.

Patients were excluded from this study if they were insufficiently proficient in the Dutch language, if they were addicted to alcohol or drugs, or if they suffered from symptoms from the psychotic spectrum. Healthy controls were recruited through advertisements. They were age, sex and education matched to the patients with OCD included in the study. Controls were excluded when they had OCD or any other current psychiatric disorder, including alcohol and drug abuse, or were non-fluent in Dutch.

The final sample consisted of 24 patients ($M = 34.33$ years, $SD = 9.09$, 16 females) with a primary OCD diagnosis and 24 age/sex/education matched non-clinical controls ($M = 34.29$ years, $SD = 13.26$, 16 females) who received a small remuneration in return for their participation. The highest educational level was determined using a 3 point scale (1: primary education, low-level vocational training & intermediate general vocational training/2: intermediate professional vocational training & college-bound high school/3: college & university), which did not differ between the OCD patients ($M = 2.29$, $SD = .75$) and non-clinical controls ($M = 2.46$, $SD = .72$). Participants gave oral and written informed consent. The study was approved by the Medical Research Ethics Committee (MREC) of the University Medical Center (UMC) Utrecht.

3.2. Procedure

Participants were tested in a dimly lit and quiet room where they sat at a table with a PC and a response box. Instructions were partly presented on the computer screen and were partly explained by the experimenter. The experimenter was present in the same room during the whole task, in order to be able to explain any obscurities or answer questions if necessary. First, participants received information about the study and filled out the informed consent. Then, they filled out the questionnaires (OCI-R, Y-BOCS, BDI-II and BAI). Next, participants started with the perseveration task (see *Materials and Design*), which started with a training phase. After the training phase, participants started with the experiment, which consisted of 60 trials. Participants were asked to fill out questionnaires about dissociative uncertainty and intolerance of these feelings after both the first and second trial (Time 1), and after both the 59th and 60th (Time 2) trial of the experiment. The reason to administer the questionnaires at these trials and not throughout the experiment was to reduce effects of repeated testing (e.g., answers to later questions being motivated by a wish to remain consistent with earlier answers). At the end of the last trial, participants were asked to fill in the PDEQ. The duration of the total experiment was approximately 50 min.

3.3. Materials and design

The perseveration task that was used in this study is based on the relatedness decision task of Giele et al. (2013). Instead of repeating motor behavior, participants in the current study repeated neutral words. Before the experimental phase, a training phase was conducted in order to train participants in repeating words and making relatedness decisions. Participants practiced repeating a neutral prime word aloud at the same pace. They were

shown a white fixation cross (1000 ms) and subsequently a neutral word (2000 ms). The pace at which they had to repeat this word was indicated by the appearance of a white circle in the middle of a black screen. This circle was repeatedly shown for 250 ms with an interval of 350 ms. They had to repeat this word, until a short tone was presented. Participants then stopped repeating the word and had to look at the computer screen which showed a white fixation cross (1800 ms) on a black background. Next, in the middle of the screen a target word was presented and participants were instructed to indicate as quickly and accurately as possible whether this word was related or unrelated to the word they just repeated by pressing the blue (related) or yellow (unrelated) knob of a response box. After a response, the word disappeared. Then, a new word was presented on the screen and the same procedure started again.

For half of the participants, the blue (related) knob was located on the left side and the yellow (unrelated) knob on the right side of the response box, for the other half, this was reversed. During the entire experiment, participants had to keep their left hand on the left knob and their right hand on the right knob to be able to respond as quickly as possible. Their reaction times were automatically recorded by the response box. Participants had to respond within 5 s, otherwise their response was recorded as a non-response.

During the training phase, participants received feedback from the experimenter about their accuracy. The first practice trial consisted of only repeating words, from the second to the 10th trial, participants practiced with both repeating words and making relatedness decisions. In the first five practice trials, the pace to repeat the word was indicated by showing the white circle. In the last five practice trials, participants were instructed to try to repeat the word at the same pace that was practiced in the previous trials, but now the circle was not shown (just like in the experimental phase). The number of word repetitions differed between practice trials.

The experimental phase consisted of 60 trials. In each trial a new neutral prime word was repeated, but the number of required word repetitions and the presentation of related versus unrelated words differed between trials. Four conditions were created, with 15 trials of each condition, so that for half of the 60 trials the prime word was repeated 2 times (non-perseveration) and in the other half the prime word was repeated 20 times (perseveration). Furthermore, in half of the 60 trials a related target word was shown, in the other half a non-related target word was shown. This resulted in the conditions: related/2 repetitions; unrelated/2 repetitions; related/20 repetitions and unrelated/20 repetitions. The order of presentation of the conditions was pseudo-randomized over trials. To control for time effects (with respect to the dissociative uncertainty questionnaire), the randomization was created in such a way that on Time 1 (trial 1 and 2) participants had to repeat one word 2 times and another word 20 times (or vice versa), and on Time 2 (trial 59 and 60) one word 2 times and one word 20 times (or vice versa). In sum, the experiment had a mixed factorial design with three independent variables: Perseveration (perseveration/non perseveration), Relatedness (words related/words unrelated) and Group (OCD patients/non-clinical controls).

The 60 prime and 60 target words were matched between the four conditions on number of syllables, on Dutch word frequency (based on the database 'SUBTLEX-NL' (2003) which consists of 44 million words from film and television subtitles in the Dutch language; Keuleers, Brysbaert, & New, 2010) and on strength of association between the cue and the target. This strength of association was based on the Dutch Word Association Database (www.kuleuven.be/semlab/interface/index.php), in which the probability ratings of the most frequent responses (target words) to 8995

cue words can be found (De Deyne, 2010).

3.4. Measures

3.4.1. Clinical characteristics

Participants completed two self-report measures of obsessive–compulsive symptoms: the Obsessive–Compulsive Inventory-Revised (OCI-R, Foa et al., 2002), and the self-rated version of the Yale-Brown Obsessive–Compulsive Scale (Y-BOCS, Goodman et al., 1989). Participants also completed the Beck Depression Inventory-II (BDI-II, Beck, Steer, & Brown, 1996), which measures levels of symptoms of depression, and the Beck Anxiety Inventory (BAI, Beck, Epstein, Brown, & Steer, 1988; Beck & Steer, 1990), which measures severity of anxiety symptoms.

Compared to the non-clinical group, OCD patients scored significantly higher on all measures, see Table 1.

3.4.2. Dissociative uncertainty

The level of dissociative uncertainty in the relatedness decisions task was measured with the following three items, scored on a 9-point Likert scale (1 = totally disagree, 5 = not agree, not disagree, 9 = totally agree).

- 1a) While I was saying the word [WORD]* aloud, it became unreal, as if I was dreaming.
- 2a) While I was saying the word [WORD]* aloud, this word started to sound strange; different than I would normally expect.
- 3a) When I was saying the word [WORD]* aloud, I started to feel strange, as if the word [WORD]* was not clear somehow.

*The neutral word that was repeated aloud was mentioned in the brackets (e.g., ‘fork’), this word was different for each of the trials.

The first and the second item are based on items of the Clinician-Administered Dissociative State Scale (CADSS; Bremner et al., 1998) and were adapted to the present task. The third item was used in the study of Giele et al. (2013) and was also adapted to the present task. A reliability analysis suggests that the three items reflect one construct; at Time 1, Cronbach's alpha after 2 repetitions was .93 and after 20 repetitions it was .90. The combined scale was the average score of these three items.

3.4.3. Intolerance of dissociative uncertainty

The level of intolerance was measured when participants experienced a certain level of dissociative uncertainty. Therefore, participants were asked to score intolerance of dissociative uncertainty only when they scored 6 or higher on the related item which measured dissociative uncertainty (e.g., they had to score item 1b when they scored 6 or higher on the Likert scale of item 1a). Irrespectively of perseveration, a mean score of all intolerance items that were scored after the first, second, 59th and 60th trial was calculated. The level of intolerance of dissociative uncertainty was

Table 1
Descriptive statistics of the clinical characteristics.

	OCD		Non-clinical controls		df	t (p)
	M	SD	M	SD		
Y-BOCS	18.63	7.14	1.75	2.82	29.98	10.77 (<.001)
OCI-R	22.5	11.87	6.29	4.75	30.18	6.21 (<.001)
BDI-II	22.96	12.1	6.21	6.26	34.47	6.02 (<.001)
BAI	19.67	10.87	5.5	4.65	31.16	5.87 (<.001)

measured with the following three items, scored on three 100 mm Visual Analog Scales (0 = not unpleasant, 100 = very unpleasant).

- 1b) These experiences of unreality were..
- 2b) This strange sound was..
- 3b) These strange feelings were ...

3.4.4. Dissociative experiences

Dissociative symptoms were measured with the Dutch version of the Peritraumatic Dissociation Experience Questionnaire (PDEQ; Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003). This is a 10-item self-report inventory (scored on five point Likert scales ranging from 1 = absolutely untrue to 5 = absolutely true) used to assess dissociation, with well-established psychometric properties (Marmar, Metzler, & Otte, 2004). Participants were asked to rate the items of this questionnaire with respect to dissociative experiences that they might have experienced during and directly after the experiment.

4. Results

4.1. Relatedness decision task

In this task, the speed of relatedness judgments was measured after repeating words 2 or 20 times. Median values were used to minimize outlier effects, which were log-transformed to normality. From all responses, 3.33% (96 responses) were wrong and .28% (8 responses) took longer than 5s and were removed from analysis. Furthermore, 19 responses (.66%) were removed because of procedural errors. Finally, 4 responses (.14%) were removed because more than 50% of the participants responded incorrectly on this cue–target combination.

A 2 × 2 × 2 ANOVA was carried out with Perseveration (2 vs. 20) and Relatedness (related cue and target word vs. unrelated cue and target word) as within-group factors and Group (OCD patients vs. non-clinical control) as between-group factor. It was predicted that participants would be faster in making relatedness judgments for related words compared to unrelated words. This was reflected in a significant main effect for Relatedness, $F(1,46) = 10.68, p = .002, \eta_p^2 = .19$ (see Fig. 1). Overall, OCD patients were somewhat slower in

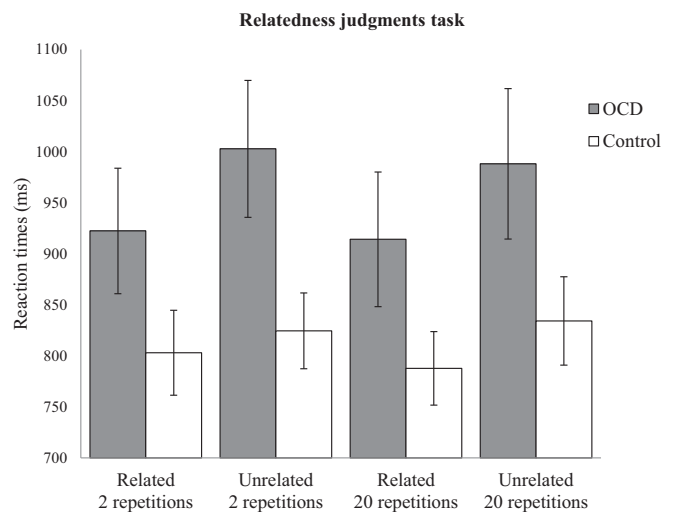


Fig. 1. Reaction times (ms) for the relatedness judgments task (related vs. unrelated) for OCD patients and non-clinical controls after 2 vs. 20 word repetitions. Error bars represent standard errors.

making related judgments than non-clinical controls, but this effect for Group was non-significant, $F(1,46) = 3.72, p = .06, \eta_p^2 = .08$. There was no delay in making relatedness judgments from 2 to 20 repetitions; the main effect for Perseveration was non-significant, $F(1,46) = .59, p = .45, \eta_p^2 = .01$. Also, all two way interactions (Perseveration \times Relatedness, Perseveration \times Group and Relatedness \times Group) and the crucial three-way interaction (Perseveration \times Relatedness \times Group) were non-significant, all F 's < 1 , all $\eta_p^2 < .02$ (see Fig. 1).

4.2. Dissociative uncertainty

A $2 \times 2 \times 2$ mixed ANOVA with Perseveration (perseveration/non perseveration) and Time (Time 1/Time 2) as within-groups variables and Group (OCD patients/non-clinical controls) as between-groups variable was performed to assess the effect of repeating words on dissociative uncertainty.

The main effect for Perseveration was significant, $F(1,46) = 43.87, p < .001, \eta_p^2 = .49$, and was qualified by the crucial Perseveration \times Group interaction, $F(1,46) = 3.57, p = .03, \eta_p^2 = .07$ (one tailed), which reflected that the effect of repeating words on dissociative uncertainty was stronger for OCD patients compared to non-clinical controls (see Fig. 2). There were no significant main effects for Time, $F(1,46) < 1, \eta_p^2 = .002$, or Group, $F(1,46) = 3.08, p = .09, \eta_p^2 = .06$. Simple main effects analysis showed that the increase in dissociative uncertainty from 2 to 20 repetitions was significant for both OCD patients, $M_{diff} = -1.8, F(1,46) = 36.24, p < .001, \eta_p^2 = .44$, and non-clinical controls, $M_{diff} = -1, F(1,46) = 11.2, p = .002, \eta_p^2 = .2$.

The Time \times Group interaction was non-significant $F(1,46) = 3.63, p = .06, \eta_p^2 = .07$. Also the two-way interaction Time \times Perseveration and the three-way interaction Time \times Perseveration \times Group were non-significant, both F 's < 1 .

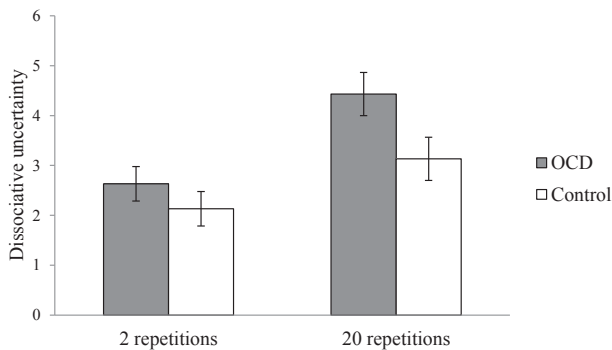


Fig. 2. Mean scores on dissociative uncertainty after 2 and 20 word repetitions. Error bars represent standard errors.

4.3. Intolerance of dissociative uncertainty

An exploratory analysis was conducted to test whether dissociative uncertainty would induce more intolerance in OCD patients compared to non-clinical controls. Fifteen OCD patients and 11 non-clinical controls had at least one rating on intolerance of uncertainty and were included in the analysis. Since the scores on intolerance of uncertainty were not normally distributed in the OCD patient group, a non-parametric analysis was carried out. Mann–Whitney U test revealed that the mean score on intolerance of dissociative uncertainty of OCD patients ($M = 44.38, SD = 21.39$) did not significantly differ from the mean score of non-clinical controls ($M = 31.39, SD = 26.51$), $Z = -1.43, p = .15$.

4.4. Dissociative experiences

OCD patients scored significantly higher on the PDEQ, $M = 2.13, SD = .79$, than non-clinical controls, $M = 1.54, SD = .58, t(46) = 2.99, p = .004$. This indicates that they experienced more dissociative experiences during and directly after the experiment.

5. Discussion

The results of part I showed that a spreading of activation effect was found; participants were faster in making relatedness judgments when the repeated word and the target word on the screen were related, compared to unrelated word combinations. However, contrary to our hypothesis, there was no effect of repetition, as spreading of activation was not disrupted after 20 word repetitions. Overall, patients with OCD were slower in making relatedness judgments than non-clinical controls. This could probably be explained by higher levels of symptoms of depression in the OCD group.

Although word repetition did not blocked spreading of activation, repeating words induced dissociative uncertainty; both groups of participants scored significantly higher on dissociative uncertainty after 20 word-repetitions compared to 2 word-repetitions. As hypothesized, this effect was stronger in OCD patients than in non-clinical controls. Furthermore, patients with OCD reported more dissociative experiences during and after the experiment compared to non-clinical controls, as indicated by a higher score on the PDEQ. No significant difference was found between patients with OCD and non-clinical controls with respect to their intolerance of dissociative uncertainty.

In the second exploratory part of this study we examined whether the dissociative uncertainty that was found after controlled perseveration (e.g., part I of this study) is also present after (clinical) perseveration carried out by OCD patients in their own personal environment. Each patient selected an idiosyncratic perseverative behavior. We hypothesized that OCD patients would report more dissociative uncertainty after carrying out this perseverative behavior compared to moments when they did not engage in repeated behavior.

6. Part II

The second part of the study aimed to determine the effects of real-life perseverative behavior on dissociative uncertainty in patients with OCD. As noted above, several studies have reported that OCD patients in general report more dissociative symptoms than normal controls (Rufer, Fricke, Held, Cremer, & Hand, 2006). Dissociation is defined as a disruption in the integrated functions of consciousness, memory, identity, or perception of the environment (American Psychiatric Association, 2000). Paradisis, Aardema, and Wu (2015) instructed OCD patients to complete a battery of questionnaires, including questionnaires that measured depressive, anxiety, schizotypal and dissociative symptoms. Dissociation emerged as one of the strongest predictors of OCD symptoms in this clinical sample. Interestingly, compared to other OCD symptoms, checking is most strongly related to dissociation (Rufer et al., 2006; Watson, Wu, & Cutshall, 2004). Moreover, elevated dissociation scores in patients with OCD predicted poorer CBT outcome (Rufer et al., 2006). These studies investigated dissociation as a trait, a relatively stable characteristic of patients with OCD. Perseveration which is induced under controlled laboratory conditions provokes dissociative uncertainty. This suggests that 'clinical' perseveration performed by patients with OCD is attended by state dissociation. Therefore, measuring dissociative uncertainty in OCD patients during clinical perseveration (in their own personal environment)

is an important addition to the present laboratory studies. This is the first study that investigates this possible underlying mechanism in a clinical sample. We expected that the same dissociative uncertainty that is found in healthy individuals after experimenter-induced perseveration (Giele et al., 2013) is present after 'clinical' perseveration carried out by OCD patients in their own environment (e.g., at home).

7. Method

7.1. Participants

The OCD participants of part I were asked in a semi-structured interview if they engaged in compulsive behavior in their own environment (e.g., at home). Six patients were excluded because they mainly reported obsessions. Next, it was explored whether these compulsions were perseverative. This meant that they engaged in prolonged (e.g., staring a light switch) and/or repeated behavior (e.g., checking the gas stove) or engaged in a sequential series of different compulsive behaviors (e.g., before leaving the house, checking the doors, windows, taps, coffee machine, etc. in a pre-established order/routine). Three patients were excluded because they reported compulsions which were not perseverative (e.g., performing a check only once or twice). Furthermore, one patient was excluded because the perseverative behavior was very infrequent and therefore unpredictable. Finally, one patient could not participate because she did not have a mobile phone, which was necessary to participate.

One patient engaged only in part II of this study (and not in part I). This resulted in 14 OCD patients that participated in the second part of this study. Four of them did not return the questionnaires and one patient was excluded from analysis because she completed the questionnaire at other moments than instructed. Finally, a small sample of nine OCD patients ($M = 35.67$ years, $SD = 7.18$, 8 females) was included in the analysis.

7.2. Procedure

In accordance with the patient, one idiosyncratic perseverative behavior or one series of different compulsions was individually selected. It was determined when, where and how long patients normally carried out this specific repeated behavior (e.g., before going to work; checking the lights and doors for ± 15 min). Next, for the perseveration condition, three moments during an upcoming period of seven days were selected when the patient expected that he or she would engage in this repeated behavior. Participants were instructed to immediately fill in the questionnaire on dissociative feelings (Measures) after finishing their perseverative behavior on these three pre-selected moments. To check if participants actually engaged in perseverative behavior during the designated time period, participants were asked to indicate this on the questionnaire.

In the same week, for the non-perseveration (control) condition, a minimum of five episodes were pre-selected in which participants indicated that they most likely would *not* engage in compulsive behavior (e.g., on Tuesday, watching television between 20.00 pm and 23.00 pm). During those episodes, five random moments (max. one per episode) were selected by the experimenter in which participants received a text message on their mobile phone. This text message instructed them to complete the dissociative uncertainty questionnaire (control condition). Patients were also asked whether they engaged in compulsive behavior during that specific (control) time period. Since we expected that it would be highly probable that participants would, unintentionally, engage in perseverative behavior during the

control moments, participants were instructed to fill out this questionnaire five times (compared to three times in the perseverative condition) in order to obtain sufficient control data. The questions referred to a time period that was of the same length as the time period that was needed to execute compulsions in the perseverative condition. For example, if a patient checked his/her gas stove every morning for 15 min, after receiving the text message for the control measurement, the patient indicated how much dissociative uncertainty he/she had experienced during the last 15 min.

7.3. Design

The home-task had a within-subjects design with Perseveration (perseveration/non-perseveration) as the independent variable. Participants completed the same questionnaire about dissociative uncertainty directly after performing perseverative behavior (perseveration condition), and after moments when they did not perform perseverative behavior (non-perseveration condition).

7.4. Measures

7.4.1. Clinical characteristics

The sample of nine OCD patients scored respectively 21.22 ($SD = 8.56$) on the OCI-R, 22.11 ($SD = 7.22$) on the Y-BOCS, 19.67 ($SD = 12.23$) on the BDI-II and 16.67 ($SD = 9.43$) on the BAI.

7.4.2. Dissociative uncertainty at home

Dissociative uncertainty at home was measured with the following three items, which were scored on a 9-point Likert scale (1 = totally disagree, 5 = not agree, not disagree, 9 = totally agree), and were also used in the study by Giele et al. (2013).

- 1) During the last [xx]* minutes there were moments when things seemed unreal, as if I was dreaming
- 2) During the last [xx]* minutes I experienced moments when it seemed as though I was looking through fog, as if everything was further away/unclear
- 3) During the last [xx]* minutes there were moments when I started to feel strange, as if it was not clear somehow

*The specific time duration was determined for each patient individually (depending on the duration of the compulsive behavior that was reported in the interview).

The first two items were based on items of the Clinician-Administered Dissociative State Scale (CADSS, Bremner et al., 1998) and adapted to relate to dissociation during a specific time period. The third item was generated by the authors and was also used in the first part of this study.

8. Results

8.1. Clinical characteristics

The mean onset of obsessive-compulsive symptoms was 20.56 years ($SD = 12.3$) (year of onset was missing for one participant). The perseverative compulsions or rituals that were selected had a mean duration of 16.8 min ($SD = 14.3$). The perseverative behaviors were: 1) checking the house when leaving (e.g., checking lamps, plugs and sockets), 2) checking and staring at the shower tap, 3) repeatedly cleaning the kitchen table and worktop, 4) checking e-mails (repeatedly reading the text and email address), 5) repeatedly washing the face, 6) checking if the windows are closed and electrical devices are turned off, 7) repeatedly checking a series of objects in the house for traces of a (non-existent) lover of the partner

(e.g., checking the bed, towels, bottles, closet, etc.), 8) cleaning and ordering objects and putting things right (symmetry) and 9) cleaning herself after arriving home (e.g., repeated and prolonged hair and hand washing).

8.2. Dissociative uncertainty at home

In the perseverative condition, one patient reported on one questionnaire that she did not engage in perseverative behavior during the whole time period. Six patients reported that they engaged in perseverative behavior during one or more control moments. These questionnaires were excluded from analysis. One participant did not complete the questionnaires at two control moments and one participant did not complete one questionnaire after perseveration. For each condition, mean scores per participant were calculated for the remaining questionnaires (≥ 2 per participant).

Since the scores on dissociative uncertainty were not normally distributed in the non-perseveration condition, a non-parametric analysis was carried out. Wilcoxon Signed Ranks Tests revealed that dissociative uncertainty was significantly higher after perseveration, $M = 4.45$, $SD = .83$, compared to non-perseveration, $M = 1.5$, $SD = .5$, $Z = -2.20$, $p = .014$ (one-tailed).

9. Discussion

The results of this study suggest that 'clinical' perseveration induced dissociative uncertainty. OCD patients reported more dissociative uncertainty after perseveration compared to control moments in which they did not engage in perseverative behavior in their own environment. However, several limitations of this study should be taken into account. First, the number of patients that participated in this study was very low. Unfortunately, we had to exclude eleven patients that participated in the first study, mainly because they did not engage in perseverative behavior. Furthermore, it is important to mention that 2 out of 9 participants in this second part of the study reported no dissociative uncertainty after carrying out their perseverative behavior (mean score of 1). Due to this small sample size, it is not possible to draw strong conclusions and further research is necessary. A final point to note is that the dissociative uncertainty questionnaire is –to some degree– an ad hoc scale. Further research would benefit from the development of a validated scale for this type of studies. Furthermore, it would be interesting to include clinical observations of dissociative uncertainty.

10. General discussion

In the first part of this study we hypothesized that compulsively repeating words would induce semantic satiation. First, we expected that this semantic satiation effect would be objectively observed, reflected by delayed relatedness judgments from 2 to 20 word repetitions. Second, we predicted that the experiential end point of this satiation effect would be reflected by an increase in experienced dissociative uncertainty from 2 to 20 word repetitions. Furthermore, we theorized that semantic satiation effects were stronger in the OCD group compared to the non-clinical group and that experiences of dissociative uncertainty were less tolerated by OCD patients.

No effects were found on objective measures. Participants' speed of making relatedness judgments in favor of related word combinations (vs. unrelated combinations) was not disrupted after perseveration. These findings are in contrast with the study by Giele et al. (2013), who found that after 2 repetitions, healthy participants were faster in their relatedness judgments when the

checked object and the picture were related rather than unrelated, and this spreading of activation effect was blocked after 20 repetitions, where reaction times were similar.

With respect to the subjective experience of dissociative uncertainty, the hypothesis was confirmed; dissociative uncertainty increased after repeating words. This finding adds to the evidence provided by former studies which demonstrated that perseveration is a dysfunctional strategy to reduce doubt (e.g., van den Hout & Kindt, 2003a). Interestingly, the impact of perseveration was stronger in OCD patients compared to controls: patients with OCD showed a higher increase in dissociative uncertainty from 2 to 20 word repetitions. These findings are in contrast with the results of earlier studies. Boschen and Vuksanovic (2007) found that, overall, OCD patients showed less confidence in their memory compared to controls. However, the decline in memory confidence after repeated checking did not differ between OCD patients and healthy controls. The study of Dek, van den Hout, Engelhard, Giele, and Cath (2015) also revealed no differences in meta-memory effects of repeated checking between patients and non-clinical controls. A difference between the current study and these studies is that they did not measure the dissociative component of uncertainty. Possibly, patients with OCD are more vulnerable to the dissociative effects of perseveration.

Following van den Hout et al. (2009), we used the term dissociative uncertainty. A possible limitation of the current study is the conceptualization of this term. It is unclear whether dissociation and uncertainty really measure different constructs. It might be argued that feelings of uncertainty result from the dissociative experiences that are induced by a blocked spreading of activation of semantically related concepts. However, it seems somewhat artificial to untangle the two concepts. Clinically, it appears that the uncertainty of OCD patients has a dissociative component (Ruffer et al., 2006). Thus, although the term 'dissociative uncertainty' is chosen somewhat ad hoc, it probably makes most sense to combine both concepts into one construct. Consequently, with dissociative uncertainty we refer to a condition that is characterized by feelings of uncertainty and dissociation. Nevertheless, it would be desirable to investigate the 'dissociation – uncertainty' link more closely and to develop better validated outcome measures.

Note meanwhile that the items used in both studies to measure this dissociative uncertainty focus on derealization. We used two items of the derealization subscale of the CADSS (Bremner et al., 1998). Also the third item is related to feelings of unreality or detachment from the outside world. Derealization is arguably a specific manifestation of dissociation and 'derealized uncertainty' may better capture the experience measured by the items. Recent research suggest that the construct of dissociation (in OCD) is wider. For example, Soffer-Dudek, Lassri, Soffer-Dudek, and Shahar (2015) suggested that obsessive compulsive symptoms are linked to dissociative absorption, a tendency to become so absorbed in a single (internal or external) stimulus, that other stimuli are ignored or overlooked. Aardema and Wu (2011) demonstrated that absorption was a consistent predictor of OC symptoms in a non-clinical sample. Dudek et al. (2015) showed that, compared to other dissociative factors, dissociative absorption was the most important predictor of obsessive–compulsive symptoms. They also found that checking was strongly associated with absorption. Possibly, perseveration not only induces feelings of derealization, but also provokes this dissociative absorption by narrowing the attention towards the threatening stimulus. Soffer-Dudek et al. (2015) state that dissociative absorption is accompanied by difficulties in multitasking, daydreaming and automatic behavior. Dek et al. (2015) found that repeated checking leads to automatization of checking behavior in OCD patients and non-clinical controls. Further research is necessary to investigate whether this automatic

behavior is associated with dissociative absorption.

Inferential confusion is also linked to dissociation. It is defined by O'Connor and Aardema (2003) as mistaking an imagined possibility for a real probability. These authors mention that at the point that the patient crosses from the real world to the imagination, patients with OCD may experience dissociative feelings, like derealization. The consequence is that patients engage in compulsive rituals, by the wish to change their imagined possibilities through acting in reality. For example, a person who is obsessed with the imagined idea that he has run someone over with his car, may check the road for signs of this accident. However, it is difficult to directly link this inferential confusion to our study. We found that perseveration induces dissociative uncertainty, while the inferential confusion model implies that these dissociative experiences are prior to compulsive behavior. Yet, O'Connor and Robillard (1995) described that compulsive behavior results in distancing the person from reality, as they rely on their imaginary narrative. As a consequence, feelings of doubt and derealization increase. The person is caught up in performing compulsions and feels like living 'in a bubble', dissociated from reality (O'Connor, & Aardema, 2012).

After the experiment, both groups scored above the suggested cut-off score for clinically significant levels of state dissociation on the PDEQ questionnaire (Marmar, Weiss, Metzler, & Delucchi, 1996). OCD patients experienced significantly more dissociative symptoms after the experiment than non-clinical controls. Their mean score of 2.13 is just below the score of civilians (2.30) that were recently (within 2 weeks earlier) exposed to a traumatic event (Sijbrandij et al., 2012). Thus, patients with OCD reported a higher level of *state* dissociation than non-clinical controls. As noted in the introduction, OCD patients report more dissociative symptoms in general (Goff et al., 1992). Perhaps our findings can partly explain these elevated scores on *trait* dissociation. It is possible that patients with OCD report more symptoms on dissociative questionnaires, because they actually experience dissociative feelings during and after their, frequent, execution of perseverative behavior. However, a possible limitation of this study is that we have not measured the PDEQ before the experiment. Therefore, it is possible that participants were already dissociative at the start of the experiment. This should be taken into account in future research.

Although the mean score on intolerance of dissociative uncertainty appeared to be higher for patients with OCD than for non-clinical controls, this difference was not significant. However, this analysis of intolerance of dissociative uncertainty should be considered highly exploratory due to several methodological limitations. First, intolerance of uncertainty was only measured if participants experienced a certain level of dissociative uncertainty. Therefore, only slightly over half of the participants were included in the analysis, suggesting a lack of power. Second, mean scores were based on different amounts of scores; some participants only scored one item, whereas others filled in nine items. This resulted in a somewhat unbalanced design.

Thus, the current study showed that patients report more dissociative uncertainty after perseveration than controls, and that both groups did not differ with respect to their intolerance of these uncertainty feelings. It is tempting to speculate that patients with OCD are trapped in a vicious circle of checking and uncertainty because the impact of perseveration is stronger. Although the results on intolerance of uncertainty should be interpreted with caution, it is possible that OCD patients do not engage in more perseveration because they experience a higher intolerance of their uncertainty feelings, but because they experience more dissociative uncertainty *in itself*. However, as mentioned in the introduction, several studies have found that OCD patients report more (general)

feelings of intolerance of uncertainty than controls (e.g., Holaway, Heimberg, & Coles, 2006; Steketee et al., 1998; Tolin et al., 2003). It remains unclear whether a state of dissociative uncertainty during and directly after perseveration is less tolerated by patients with OCD. This awaits future research.

One major difference between the study of Giele et al. (2013) and the current study is the stimulus material. In the study of Giele et al. (2013) participants repeated different forms of OC related motor behavior (e.g., physically checking a coffee machine) as opposed to the verbal perseveration of neutral words in the current study. Since previous studies have demonstrated that different forms of perseveration (e.g., checking, prolonged staring or repeating sentences) induce dissociative uncertainty (van den Hout & Kindt, 2004; van den Hout et al., 2008; 2009), and different forms of perseveration (e.g., repeating words, pictures or behavior) result in semantic satiation (Giele et al., 2013; Lewis & Ellis, 2000; Pynte, 1991; Smith, 1984), in the current study it appeared not necessary that participants engaged in repeating *motor* behavior (like checking). To limit the inconvenience for patients, in the present study participants had to repeat neutral words (perseveratively or non-perseveratively) rather than motor behavior. On the one hand, one could argue that it is therefore unclear whether the differences in the results of the current study and the earlier study (Giele et al., 2013) are due to differences in form (words vs. motor behavior) and/or valence (neutral vs. OC-related) of the perseveration task. Possibly, only OC-related motor behavior is sensitive to the effects of perseveration. On the other hand, several studies unrelated to OCD research have shown that repeating neutral words induces a blocked spreading of activation of semantically related words (e.g., Sanbonmatsu et al., 2007; Smith, 1984; Pynte, 1991). Moreover, the effects of OC-like perseveration in the study by Giele et al. (2013) were tested in non-clinical students, thus the checking operations that were performed had no idiosyncratic meaning for the participants.

One methodological limitation should be mentioned. There were used 60 word-combinations of a repeated prime word and an associated target word (e.g., apple - pear) in the task. Half of the repeated words were randomly assigned to a target word of another combination (e.g., apple - ink). Thus, if a person repeated the word 'soap' and this was followed by the target word 'pear' (unrelated), the word 'apple' would always be followed by a non-related word (e.g., 'ink') because the related target word 'pear' was already used in an earlier trial. Hypothetically, participants were able to predict in some trials if the target word would be related or unrelated to the repeated word. In practice, however, it is very difficult to remember all those word combinations and possibly only a minority of the participants 'detected' this rule. Therefore it seems plausible that this only had a minor effect on the outcome of this study.

In sum, the results only showed subjective effects due to perseveration: repeating words induced feelings of dissociative uncertainty. This study found no indications that semantic satiation might be the underlying mechanism of the perseveration → dissociative uncertainty cascade. Possibly, the study of Giele et al. (2013) in which perseveration did lead to blocked spreading of activation represented a chance finding. Another possibility might be that the blocked spreading of activation that was found in that particular study is another effect of perseveration which, however, is not specifically related to dissociative uncertainty. Further research is necessary to elucidate the specific mechanisms underlying the detrimental effects of perseveration.

The second part of this study showed that OCD patients who engaged in 'clinical' perseverative behavior reported more dissociative uncertainty compared to moments in which they were not perseverating. These findings underscore the notion that the effects

of perseveration on dissociative uncertainty are clinically relevant. However, the number of participants who engaged in perseverative behavior was very low. Possibly, dissociative uncertainty is not experienced at all by a subgroup of OCD patients. A next step would be to elucidate the relevance of the current findings for the general population of patients with OCD. In future research, it would be therefore be valuable to explore the percentage of OCD patients that engage in perseverative behavior and experience feelings of dissociative uncertainty.

As mentioned above, most former studies were conducted in lab settings with non-clinical persons. With the current study we aimed to gain more insight in the 'perseveration → dissociative uncertainty' phenomenon by testing the effects of perseveration in a clinical sample. Moreover, it was proposed to make a further step in understanding the possible mechanisms by which OCD is maintained; how compulsive perseveration leads to a vicious circle of doubt and dissociation. Although the mechanism through which perseveration induces uncertainty is still unclear, the findings of this study add to the growing list of studies that provided proof for the detrimental effects of compulsive perseveration. This effect is not restricted to a laboratory setting; 'clinical' perseveration induces the same feelings of ambivalence.

The findings may provide another theoretical rationale for current treatments in OCD, like Exposure and Response Prevention (e.g., Franklin, Abramowitz, Kozak, Levitt, & Foa, 2000). In this therapy, patients are confronted with anxiety-evoking stimuli, while refraining from compulsive behavior. In this way, they discover that compulsive behavior is unnecessary to prevent harm. Consequently, their anxiety for those stimuli diminishes over time through this process of extinction (Abramowitz, Taylor, & McKay, 2009). The findings of the current study suggest that when patients are motivated to quit their compulsive perseverations, this may counteracts the ironical effects of this behavior. During ERP, their feelings of uncertainty may not only reduce because of extinction processes, but also because the negative effects of perseveration are blocked.

ERP requires significant effort by OCD patients. They are often unwilling and afraid to refrain from their compulsive behavior, which makes many of them refuse to engage in ERP therapy or drop out at an early stage (Maltby & Tolin, 2005). In addition to the psycho-education that is given in ERP, it may be helpful to inform patients about the negative effects of perseveration. We underscore the suggestion of Radomsky, Shafran, Coughtrey, and Rachman (2010) and Shafran, Radomsky, Coughtrey, and Rachman (2013) to incorporate behavioral experiments into treatment methods. It may improve their therapy outcome when they experience that their perseverative behavior is not only useless, but even increases OC symptoms like dissociative uncertainty. Possibly, some patients with OCD misinterpret their dissociative feelings during perseveration. They may be afraid that something is wrong with them or that they go insane. If they understand that those feelings are normal consequences of engaging in compulsive behavior, this may reduce anxiety.

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