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Phenomenal Characteristics of Memories of Daily Actions in Checking-Prone Individuals

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KEYWORDS : Obsessive-Compulsive Disorder; Obsessive Behavior; Obsessive beliefs

ABSTRACT

The purpose of this study was to investigate memories of daily actions in checking-prone participants. A sample of 419 non-clinical participants completed a questionnaire evaluating Obsessive-Compulsive Disorder (OCD) and a questionnaire evaluating sensory details, emotions, vividness, confidence and memory perspective of seven everyday actions such as 'brushing one's teeth'. The main results indicated that checking was related to low levels of visual, kinaesthetic and spatial details in memories for actions, more negative emotions and anxiety when performing actions and low confidence in memory quality. In addition, checking-prone individuals more frequently reported their memories from the perspective of an external observer than non-checking-prone individuals. In general, these results seem to indicate that checking is associated with impersonal memories for everyday actions, as well as low confidence in these memories. The role of anxiety is also evoked, as it was significantly related to poor memory characteristics.

Several studies have investigated the possible existence of memory deficits in Obsessive-Compulsive Disorder (OCD), and in particular in individuals presenting checking rituals (i.e. 'checkers'). More specifically, it has been hypothesised that checkers may find it difficult to figure out whether they have really performed an action (such as locking the door) or whether they only imagined it; in other words, their *reality monitoring* capacity is impaired (Johnson & Raye, 1981). According to Johnson and Raye, one's reality monitoring capacity, or the ability to distinguish a real from an imagined event, depends primarily on an evaluation of the event's memory characteristics in conjunction with the judgement processes used to assess them (Johnson, Hashtroudi, & Lindsay, 1993). In fact, Johnson and colleagues have shown that memories of perceived events contain more details and more perceptual and contextual information than memories of imagined events (e.g. Johnson, Foley, Suengas, & Raye, 1988; Suengas & Johnson, 1988). Consequently, in order to determine whether an event was perceived or imagined, individuals principally base their judgements on contextual and perceptual information contained in the memory. A problem distinguishing a real from an imagined event could therefore be due either to poor and not very detailed memories of real events or to very vivid and detailed representations of imagined events.

Concerning OCD, a number of studies have investigated motor memory and reality monitoring

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abilities. Reed (1977, 1985), who was one of the first researchers to explore this issue, postulated that OCD subjects' memory problems result from impersonal memories. That is, Reed suggested that checkers remember actions from the perspective of a non-participant observer and tend to rely on visual imagery rather than on kinaesthetic information. However, experimental explorations of reality monitoring and motor memory abilities have led to mixed results. Some of them revealed deficits in clinical or sub-clinical checkers (Ecker & Engelkamp, 1995; Sheffler Rubenstein, Peynircioglu, Chambless, & Pigott, 1993; Sher, Frost, Kushner, Crews, & Alexander, 1989; Sher, Frost, & Otto, 1983; Sher, Mann, & Frost, 1984), whereas others found no such deficit in clinical checkers (Brown, Kosslyn, Breiter, Baer, & Jenike, 1994; Constans, Foa, Franklin, & Mathews, 1995; Hermans, Martens, De Cort, Pieters, & Eelen, 2003; McNally & Kohlbeck, 1993; Merckelbach & Wessel, 2000). Methodological issues may partly account for these contradictions. A recent study tried to overcome these limitations and evaluated memory for actions in 75 non-clinical individuals (Zermatten, Van der Linden, Laroi, & Ceschi, 2006). The results indicated motor memory deficits, a tendency to report action from the perspective of an external observer, and reality monitoring difficulties in checking-prone participants (partly explained by a state of dissociation), confirming the memory deficit hypothesis.

In another study (Zermatten, Van der Linden, D'Argembeau, & Ceschi, 2007), the authors tried to better understand the possible reality monitoring deficits by exploring qualitative ('phenomenal') characteristics of checkers' representations of real and imagined events, in order to determine whether checkers report dim memories of real events or particularly vivid representations of imagined experiences. For this purpose, the authors adapted a questionnaire developed by Johnson et al. (1988): the Memory Characteristics Questionnaire (MCQ). In the MCQ, participants are requested to evaluate autobiographical events, and to rate these events on Likert scales assessing different characteristics, such as sensory details (visual, tactile, auditory, gustatory and olfactory), contextual information (e.g. spatial and temporal) or associated emotions. Different versions of the MCQ have been used in a number of studies; overall, they reveal that more sensory and contextual information is contained in memories of perceived events than of imagined ones, and in memories of positive events than of negative ones (D'Argembeau, Comblain, & Van der Linden, 2003; Destun & Kuiper, 1999; Johnson et al., 1988; Raspotnig, 1997).

In the modified version used (Zermatten et al., 2007), participants were requested to retrieve one negative, one neutral and one positive autobiographical memory, as well as to generate one negative, one neutral and one positive imagined experience. The characteristics explored were sensory details, contextual information, intensity of feelings, general vividness of the real and imagined events and the point of view adopted by the participants in the events they reported (i.e. whether they 'saw' the situation as if they were an external observer, saw it from their own point of view, or saw it from neither of these perspectives, see Nigro & Neisser, 1983). The main results for a sample of 79 undergraduate students indicated that non-checking-prone participants reported more vividness overall than checking-prone individuals. Moreover, non-checking-prone participants reported more visual details and more vividness for real than imagined experiences, while no difference between real and imagined events was found for checking-prone participants. One possible conclusion is that checkers might confuse real and imagined events, since both present the same amount of visual details and vividness. These results suggest that checking-prone

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participants report dim memories of real events, rather than vivid memories of imagined events, which could partly explain their reality monitoring difficulties. No difference between groups was found for other characteristics, however, in particular kinaesthetic details or perspective of memories. This challenges Reed's hypothesis that checkers' memories are characterised by poor kinaesthetic details and an observer's perspective. However, it is possible that impersonal memories tend to concern specific actions and not general events. Given this possibility, we found it necessary to specifically investigate memories of actions. Furthermore, the sample in the Zermatten et al. (2007) study was not very large (79 participants), so we wanted to explore the qualitative characteristics of memories for actions in a larger sample.

The aim of the present study was thus to investigate the quality of memories for real actions in checking-prone individuals. More specifically, we asked participants to retrieve memories of seven daily actions, and to evaluate them according to several characteristics such as sensory details, spatial localisation, emotion, vividness and confidence. Autobiographical remembering of actions can be understood in the context of the autobiographical model developed by Conway (Conway, 2005; Conway, Singer, & Tagini, 2004), which explores the relations between autobiographical memory, episodic memory and the self. In Conway's conceptualisation, autobiographical memory is seen as emerging from the intersection of two competing demands. The first one ('adaptive correspondence') concerns the need to encode events as a highly detailed record of reality. It allows one to accurately encode, for example, whether one has drunk a cup of coffee or locked the door in the morning, in order to avoid repeating these actions. These short episodes (lasting some seconds, minutes or hours) are stored in episodic memory, which also contains all the information about the sensory, perceptual, cognitive or affective details of these episodes. However, an efficient memory system cannot retain thousands of memories of everyday activities. Thus, Conway suggests that all recent memories are on a 'forgetting trajectory' and are forgotten in about 24 hours, unless they relate to the individual's long-term goals. This represents the second demand of autobiographical memory, namely 'coherence'. Coherence corresponds to the long-term store of memories consistent with the goals, self-images, attitudes, values or beliefs of an individual. If we consider checking in light of this model, we could postulate that the correspondence demand is deficient. One can, for example, postulate that the record of daily actions (such as checking) in episodic memory is not sufficiently precise and detailed, leading patients to repeat these actions. In our study, we wanted to evaluate specific details of such daily activities, and thus we were particularly interested in actions performed during the last 24 hours.

In brief, our main hypothesis was that checking symptoms would be related to less detailed action memories, in particular concerning motor/kinaesthetic information, as postulated by Reed (1977). Moreover, checking symptoms would be related to a tendency to see action memories from the perspective of an external observer (Reed, 1977). In sum, the fact that they remember their actions from an observer perspective and without kinaesthetic details could lead checking-prone participants to doubt whether they have really performed the actions ('did I do that or did I only imagine it?'), which in turn leads them to check.

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METHOD

PARTICIPANTS

From an original sample of 430 participants, six individuals were excluded because of extensive missing data. In addition, five outliers presenting clear extreme data were excluded. The final sample therefore included 419 volunteer participants from the community (210 females and 209 males) aged between 20 and 35, with a mean age of 25.47 (SD = 3.92). Their mean years of education amounted to 14.79 (SD = 2.33). The characteristics of the sample are presented in Table 1.

For some of the analyses presented in the next section, two groups were created based on participants' checking sub-scores on the Obsessive-Compulsive Inventory-Revised (OCI-R, Foa et al., 2002). The non-checking-prone group *(N* = 100) included participants within the lowest quartile of the distribution, that is with a checking score of 0, and a low score for washing (<2). The checking-prone group (N = 77) consisted of individuals with a high score for checking (greater than the second quartile of the distribution, that is, >2) and with low scores for washing (<2). As shown in Table 1, no significant differences were found between the groups for age and education. However, significant differences were observed in terms of obsessive-compulsive symptoms, anxiety and depression. In addition, it should be noted that the OCI-R checking scores of our checking-prone group (M = 4.73; SD = 2.14) were similar to the OCI-R checking scores (M = 4.83; SD = 3.86) of a clinical OCD population (Foa et al., 2002). We must, anyway, mention that participants were not diagnostically evaluated for OCD.

MATERIALS

Autobiographical actions memory questionnaire

This questionnaire was inspired by the MCQ developed by Johnson et al. (1988). In the version we used, participants were asked to retrieve memories of seven daily actions. More specifically, they had to think of the last time they had (1) brushed their teeth, (2) washed their hands, (3) gone up stairs, (4) put a coat on, (5) drunk something, (6) locked a door and (7) put their shoes on. If participants did not have any memory of the last time they had carried out one of these actions, they passed to the next action. The actions selected were simple everyday actions that were gender-neutral and as universal as possible. One of the actions was more explicitly related to checking (locking a door). However, even actions considered to be neutral for most people may be considered anxiety-provoking by some checkers. Thus, in order to control for anxiety during actions, we asked participants to rate their anxiety for each of the actions (see below).

At the beginning of the questionnaire, participants had to indicate the current date and time. Then, for each action retrieved, participants had to rate their memories along 13 dimensions. These 13 questions concerned sensory details of the event (visual, tactile, olfactory, auditory and gustatory, as well as kinaesthetic details including one question about body position and one about body movements), information about the space in which the event took place (place and spatial placement of objects), emotions (a high score indicates positive emotions), anxiety provoked by the action (a high score indicates considerable anxiety), general vividness of the memory and confidence in the quality and vividness of the memory. All dimensions were rated on 7-point Likert

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scales. Participants were then asked to indicate the perspective of their memory. Three possibilities were presented to participants, who had to say whether (1) they could see the situation like an external observer (Observer memories), (2) they could see the situation from their own viewpoint (Field memories) or (3) neither of these descriptions fitted their memory (Neither). Finally, respondents were asked to indicate the approximate time (hour and day) when each action was carried out. For each action, we therefore calculated how long ago (in minutes) it had been performed before completing the MCQ. Two versions of the questionnaire were created to vary the order of recall of the different actions.

Table 1. *Participants' characteristics (means and standard deviations)*

	Total sample (N=419)	CP individuals (77)	NCP individuals (100)	Student *t*-tests *t*(1, 53)
Age	25.47 (3.92)	25.27 (3.49)	25.44 (4.05)	n.s.
Education, years	14.79 (2.33)	14.66 (2.40)	14.78 (2.32)	n.s.
Sex ratio (F/M)	210/209	43/33	47/53	—
OCI-R	14.99 (9.25)	18.93 (7.30)	6.88 (4.44)	13.47**
OCI-R checking	2.27 (2.35)	4.73 (2.14)	0	—
OCI-R washing	1.16 (1.84)	0.36 (0.48)	0.16 (0.37)	3.18**
STAI-S	33.34 (10.50)	35.92 (11.56)	29.26 (8.96)	4.23**
STAI-T	40.41 (9.86)	43.13 (9.90)	36.04 (9.09)	4.90**
BDI-II	8.68 (7.65)	10.18 (8.09)	6.12 (6.05)	3.81**

Note: "p < .01.

CP, checking-prone; NCP, non-checking-prone; OCI-R, Obsessive-Compulsive Inventory-Revised; STAI-S, State-Trait Anxiety Inventory-State; STAI-T, State-Trait Anxiety Inventory-Trait; BDI-II, Beck Depression Inventory II.

Other questionnaires

The revised version of the Obsessive-Compulsive Inventory (OCI-R, Foa et al., 2002) is an 18-item self-report measure for assessing OCD symptoms. This version has six subscales, each containing three items: washing, obsessing, hoarding, ordering, checking and neutralising. Respondents have to indicate to what extent the situation described in each specific statement had distressed them during the past month on a 5-point scale (0 = not at all; 4 = extremely). Total scores range from 0 to 72. The OCI-R has excellent psychometric properties (Foa et al., 2002). The French version of the OCI-R used in this study has good internal consistency and has been shown to present the same factorial structure as the English version (Zermatten, Van der Linden, Jermann, & Ceschi, 2006).

In addition, participants completed a questionnaire evaluating depression (Beck Depression

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Inventory II (BDI-II), Beck, Steer, & Brown, 1998) and a questionnaire evaluating anxiety (State-Trait Anxiety Inventory (STAI), Spielberger, 1993).

Procedure

For about 1 hour, participants completed the modified version of the MCQ, the OCI-R, the STAI and the BDI-II, as well as other questionnaires unrelated to the present study. The participants completed the questionnaires on a one-on-one basis with the experimenter, in a calm and neutral setting which did not influence the participants' performance on the memory task.

RESULTS

PREPARATION OF THE DATA

Out of the 2933 total actions (419 participants x 7 actions), 7.84% were not retrieved by the participants. In addition, actions carried out less than 5 minutes before the beginning of the questionnaire (representing 3.4% of the retrieved actions) were removed in order to exclude actions that might be stored in short-term memory. Moreover, we also excluded actions that were carried out more than 24 hours before the beginning of the questionnaire (representing 4.88% of the retrieved actions). This was done because we were only interested in recent memories of daily actions, and not in memories related to the individuals' long-term goals, as described earlier in the context of Conway's model (Conway, 2005).

In order to explore the validity of our measures, we calculated the Cronbach's alphas for each of the questionnaires we used. The coefficients indicated good internal consistency for the anxiety (STAI-S: .94; STAI-T: .92), depression (BDI-II: .90) and OCD measures (OCI-R total score: .84; checking: .76; washing: .70).[1] For the MCQ, we ensured that characteristics were consistent within the seven actions. The coefficients also indicated good consistency for the different characteristics (visual details: .82; tactile details: .87; body position: .89; body movements: .89; olfactory details: .76; auditory details: .83; gustatory details: .67; place: .68; spatial placement: .79; emotions: .84; anxiety: .69; vividness: .81; confidence: .87).

MEMORY CHARACTERISTICS

For each participant (even those with missing actions) and for each characteristic, we computed the mean for the seven actions. Means and standard deviations for each memory characteristic for the total sample are presented in Table 2.

We first performed Pearson correlations between the measures of OCD, anxiety and depression. These measures were all significantly correlated, as shown in Table 3. Due to some non-normally distributed variables in the MCQ, Spearman correlations were then computed between the different memory characteristics. These correlations are presented in Table 4, and reveal that all the characteristics of the questionnaire significantly correlate with each other, except the anxiety provoked by the action, which significantly correlated with visual details, gustatory details, place, spatial placement of objects, emotions and confidence.

Spearman correlations were then performed between the different memory characteristics and the

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OCD, anxiety and depression measures in the whole sample. These correlations are reported in Table 5.

The main results indicated that the checking subscale of the OCI-R was negatively correlated with details concerning visual characteristics, body movements, body position and confidence. The results also indicated a link with negative emotions and anxiety provoked by actions. The washing subscale was only significantly related to anxiety provoked by actions, while the OCI-R total score was significantly correlated with low visual details and information about body movements, negative emotions, high anxiety and low confidence.

Table 2. *Means and standard deviations for memory characteristics*

	Total sample (*N* = 419)
Visual details	5.45 (1.18)
Tactile details	4.50 (1.41)
Body position	4.17 (1.56)
Body movements	4.45 (1.52)
Olfactory details	2.53 (1.19)
Auditory details	3.38 (1.36)
Gustatory details	2.43 (0.84)
Place	6.46 (0.73)
Placement of objects	5.73 (1.05)
Emotion	4.62 (0.91)
Anxiety	1.28 (0.51)
Vividness	5.20 (1.13)
Confidence	5.67 (1.04)

[1]*As we will use only the washing and checking subscales of the OCI-R in this study, we report here the coefficients for these subscales only.*

Table 3. *Spearman correlation coefficients between OCD, anxiety and depression measures*

	OCI-R checking	OCI-R washing	OCI-R	STAI-S	STAI-T	BDI-II
OCI-R checking	—					
OCI-R washing	.41**	—				
OCI-R	.70**	.58**	—			
STAI-S	.25**	.19**	.41**	—		
STAI-T	.30**	.24**	.50**	.64**	—	

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BDI-II	.20**	.17**	.43**	.53**	.67**	—

Note: "p < .01.

The anxiety (STAI) and depression (BDI-II) measures were shown to be linked to high anxiety and negative emotions during actions. Furthermore, state anxiety (STAI-S) was negatively correlated with visual details, body movements information, spatial details, spatial placement of objects, vividness and confidence, while trait anxiety (STAI-T) was negatively related to visual and kinaesthetic details (concerning both body position and movements). To find out whether these effects were only due to the typical 'checking' action ('to lock the door'), we performed the analyses again without this action. However, they revealed the same significant results.

In order to see whether checking, as compared to washing, predicts poor memories of actions, we performed regression analyses on each of the memory characteristics with OCI-R checking and OCI-R washing as independent variables. The results indicated that checking was a significant predictor of visual details (t =— 2.30, p < .05, β = —.12), body movements (t =—2.24, p < .05, β = -.12), place of the action (t =—2.65, p < .01, β = —.14), anxiety during the action (t = 2.18, p < .05, β = .11) and confidence (t = —2.56, p < .05, β = —.13). Furthermore, there was a trend towards significance for tactile details (t =-1.72, p = .086, β = -.09), body position (t =-1.78, p = .076, β =-.09) and vividness (t = —1.88, p = .06, β = —.10). As for washing, it was only a significant predictor for anxiety during actions (t = 2.77, p < .01, β = .14).

We then evaluated whether checking was still a predictor of memory characteristics when anxiety was entered in the regression analyses. We therefore performed the analyses on each of the memory characteristics with OCI-R checking, OCI-R washing and STAI-T as independent variables. The results indicated that checking was a significant predictor of the place of the action (t =—2.33, p < .05, β = —.13), while a trend was observed for visual details (t = —1.86, p = .06, β = —.10), body movements (t = —1.69, p = .09, β = —.09) and confidence (t =—1.92, p = .055, β = —.10). The STAI-T was a significant predictor of body position (t =—2.05, p < .05, β =—.11), emotion (t =—5.21, p < .01, β =—.27) and anxiety during action (t = 4.38, p < .01, β = .22), while washing was only a significant predictor for anxiety during actions (t = 2.42, p < .05, β = .13).

Table 4. *Spearman correlation coefficients between the different memory characteristics*

	A	B	C	D	E	F	G	H	I	J	K	L	M
Visual details (A)	—												
Tactile details (B)	.54**	—											
Body position (C)	.52**	.75**	—										
Body movements (D)	.52**		.89**	—									
Olfactory details (E)	.19**	.51**	.41**		—								
Auditory details (F)	.30**	.56**	.48**	49**	.60**	—							
Gustatory details (G)	.17**	.48**		.35**	.64**	.45**	—						
Place (H)	.48**	.30**	*	.28**	.12*	.21**	.15**	—					
Placement of objects (I)	.62**	.35**	.35**	.34**	1 /y T -T-	.22**	.16**	.67**	—				
Emotion (J)	.15**	.20**	.20**	.19**	.15**	.17**	.10*	.14**	.21**	—			
Anxiety (K)	-.11*	.02	.02	-.01	.04	.06		-.12*	-.16**	-.18**	—		
Vividness (L)	.68**	.51**	.52**	49**	.30**	.35**	**	.52**	.64**	.26**	-.11*	—	
Confidence (M)	.64**	.44**	.42**	.42**	.24**	.27**	.24**	.51**	.66**	.20**	-.12*	*.78***	—

Note: * p <.05; ** p <.01.

***Table 5**. Spearman correlation coefficients between memory characteristics and measures of OCD, anxiety and depression*

	OCI-R checking	OCI-R washing	OCI-R	STAI-S	STAI-T	BDI-II
Visual details	-.10*	-.09	-.11*	-.17**	-.13**	-.03
Tactile details	-.06	-.01	-.03	-.07	-.08	-.01
Body position	-.11*	-.05	-.08	-.09	-.14**	-.06
Body movements	-.13**	-.09	-.12*	-.11*	-.13*	-.05
Olfactory details	.01	.07	.06	.03	-.00	.03
Auditory details	-.03	-.03	-.01	-.06	-.01	.00
Gustatory details	.01	.08	.07	.06	.01	.01
Place	-.07	.03	-.02	-.10*	-.07	-.00
Placement of objects	-.07	-.05	-.09	-.17**	-.09	-.03
Emotion	-.11*	-.04	-.17**	-.22**	-.21**	-.25**
Anxiety	.20*	.15**	.36**	.25**	.32**	.31**
Vividness	-.09	-.02	-.08	-.17**	-.08	-.04
Confidence	-.10*	-.02	-.10*	-.20**	-.08	-.06

Note: * p <.05; ** p <.01.

POINT OF VIEW OF MEMORIES

When analys the total memories retrieved, we found that participants saw 61.01% of these events from their own point of view (Field or F memory), 35.10% as an external observer (Observer or O memory), while 3.89% of the events could not be classified in either of these two categories (Neither, N). In order to see whether checking-prone and non-checking-prone participants presented different proportions of these perspectives, we computed the proportion of F, O and N memories for each participant. The proportion indicated more O (39.02%), fewer F (56.54%) and more N (4.43%) memories in checking-prone than in non-checking-prone participants (32.05% O; 65.50% F and 2.45% N). A Chi-square analysis revealed a significant difference between groups on these proportions ($\chi^2_2| = 9.75$; $p < .01$).

DISCUSSION

The purpose of this study was to investigate the characteristics of memories for different daily actions in a population whose checking symptoms were evaluated. Our main hypothesis was that checking-prone participants would report dim memories of daily actions, specifically concerning kinaesthetic details and would adopt the perspective of an observer when remembering such actions. The outcomes partly confirmed our hypotheses and can be summarised as follows.

First, our results seem to confirm a link between checking symptoms and the tendency to report dim memories. Significant negative correlations were found between checking and different

characteristics of the memories, that is, visual details, body movements and body position (i.e. kinaesthetic information). In addition, the regression analysis showed that checking was a significant predictor of visual details, body movements, place of action, confidence, while there was a trend towards significance for tactile details, body position and vividness. In other words, checking symptoms seem related to less detailed action memories. These effects were found to be specific to checking as compared to washing, which was not significantly related to any of the memory characteristics, except anxiety during actions.

The result concerning the poor kinaesthetic information related to checking symptoms is particularly interesting, as it seems to confirm Reed's (1977) suggestion that checkers rely less than non-checkers on kinaesthetic information when remembering actions. This also confirms that the results of a previous study (Zermatten et al., 2007), which found no differences between groups on kinaesthetic details, may be due to the nature of the memories tested (general events rather than actions). Concerning visual details, our findings do not support Reed's (1977) prediction that checkers will rely exclusively on visual imagery when recalling an event and will favour this modality over kinaesthetic information. On the contrary, both modalities (visual and kinaesthetic) seem problematic in checking. However, this is in line with Zermatten, Van der Linden, Jermann, et al. (2006) and with Sher et al.'s (1989) study, which showed that checking individuals presented poor visual imagery when asked to report an autobiographical event such as their last holiday.

A second main result of our study revealed significant differences between checking-prone and non-checking-prone participants concerning the perspective of memories. When we considered the proportion of each of the perspectives, we observed that checking-prone participants reported fewer field (F) and more observer (O) memories than non-checking-prone participants. This is an important finding, since it seems to confirm the idea that checking-prone individuals experience a particular perspective in their memories for actions, as suggested by Reed (1977, 1985). This is also in line with an earlier study that showed a tendency to recall actions from the perspective of an external observer (Zermatten, Van der Linden, Laroi, et al., 2006). Furthermore, the present data suggest that the observer perspective of memories specifically concerns memories for actions, as no such differences between groups were revealed in a study on memories of general events (Zermatten et al., 2007). In sum, the results concerning both kinaesthetic information and the observer perspective seem to confirm that checkers have an impersonal way of remembering actions, as suggested by Reed (1977, 1985).

Another outcome of the present study indicated that checking was related to poor confidence in the quality of memories. This finding is in accordance with a growing body of research suggesting that checkers lack confidence in their memories (e.g. MacDonald, Antony, Macleod, & Richter, 1997; Tolin et al., 2001). This hypothesis assumes that checkers do not have memory difficulties as such, but rather a lack of confidence in their memory. In our view, however, and consistent with some earlier data (e.g. Tuna, Tekcan, & Topcuoglu, 2005; Zitterl et al., 2001), lack of confidence and memory deficits are not mutually exclusive. It is therefore possible that lack of confidence and memory problems coexist, and even reinforce each other. One can, for example, assume that memory difficulties lead checkers to have less confidence in their memories. On the other hand, in accordance with some previous research (e.g. van den Hout & Kindt, 2003), a lack of confidence could lead participants to verify things again, which could in turn tarnish the memory of the checking action and lead to retrieval difficulties. In any case, the coexistence of lack of confidence

and memory difficulties seems to be confirmed in the present study. Moreover, the presence of significant correlations between lack of confidence and memory characteristics confirms that these two elements are not independent. We can therefore postulate that dim memories lead to a lack of confidence in one's memories. However, one could also argue that, because of their lack of confidence, checking-prone participants tend to underestimate the amount of details their memory contains. This latter hypothesis underscores the subjectivity aspect of the MCQ, which was evoked in a previous study (Zermatten et al., 2007). It should be recalled that the MCQ allows one to study the individual's own evaluation of the memories. That is, it gives us information about the subjective quality of the memories, but it is not a direct measure of the memory traces as such. In sum, we cannot rule out the possibility that this subjective evaluation may be influenced by other factors such as lack of confidence or perfectionist tendencies (leading checkers to need more information in order to consider their memories as detailed).

With this in mind, it would be interesting to further evaluate the quality of memories by using a more direct and objective measure of kinaesthetic and visual characteristics. For example, it might be possible to propose a paradigm in which participants have to perform actions (e.g. placing objects in a bookcase) in a particular context (e.g. pictures on the wall, specific objects near the bookcase). We could then ask participants to recall the objects they had placed in the bookcase and the surrounding objects, along with visual (e.g. colour, shape of the objects) or kinaesthetic (e.g. their position when moving the object, weight of the object) details. Finally, we could ask participants to complete a subjective evaluation of the quality of their memories, such as the MCQ. This kind of procedure would provide information concerning memory difficulties in checking and their relations to the subjective evaluation of memories. We are currently developing such a paradigm.

Another point we should discuss is the role of anxiety, which seems particularly important in our data. That is, correlations were often stronger between the STAI and the different memory characteristics, or between anxiety provoked by an action and the other memory characteristics, than between checking and these characteristics. Moreover, when the STAI-T was entered in the regression analyses, it was a significant predictor of body position, emotion and anxiety during actions.

It is not surprising that anxiety should influence memory. Eysenck (1983), for example, pointed out that anxious thoughts occupy cognitive resources, and may consequently interfere with memory encoding. Rachman (2002) also stressed that anxiety influences the encoding of actions, possibly due to the fact that the participants focus on the 'threat' and on their anxiety state instead of the contextual details of the action. It is also possible that anxiety may lead to a dissociation state during the performance of the action, which could prevent rich encoding (Zermatten, Van der Linden, Laroi, et al., 2006). Moreover, anxiety may also have an influence during the retrieval of the actions, for example, due to intrusive anxious thoughts interfering with the retrieval process. This possible role seems to be confirmed by our data showing correlations between the STAI-S (anxiety measured at the time of the completion of questionnaires, i.e. when the actions were retrieved) and memory characteristics. The question we must raise, though, is whether all memory problems in checking can be explained by anxiety. This is quite a difficult issue, as anxiety is intrinsic to checking (and OCD in general). It is thus very difficult to totally separate out the respective influences of anxiety and checking in our data. Nevertheless, some points may help to clarify this issue. First, we should emphasise that when we entered the STAI-T in the regression analyses, checking continued to be a

significant predictor of some of the memory characteristics (place of the action, with a trend towards significance for visual details, body movements and confidence). In addition, if anxiety alone accounted for the memory problems reported in our data, it would be difficult to understand why checking was more specifically related to the visual and kinaesthetic details, and not to the details concerning the placement of objects, for example, which correlated with anxiety. Moreover, one must emphasise that washing symptoms were not related to the different memory characteristics, although washing was significantly correlated with anxiety. In sum, these results seem to indicate that there is a specific relationship between checking and memory characteristics, in addition to the influence of anxiety. Further work will need to re-examine this issue to shed more light on these complex relations.

Finally, it appears that depression was not significantly correlated with the memory characteristics (except emotions and anxiety during actions). That is, our results showing dim memories in checking-prone participants do not seem to be attributable to the presence of depression, in which a deficit of specificity, leading depressive individuals to retrieve more general and less detailed autobiographical memories, has been described (e.g. Barnhofer, de Jong-Meyer, Kleinpass, & Nikesch, 2002; Williams & Broadbent, 1986).

Before concluding, we should point out the main limitation on our work, namely the relatively small effects we observed. In this regard, we should emphasise that the impersonal memories for action suggested by our data constitute only one of the numerous factors implicated in checking, such as anxiety, dissociation, sense of responsibility, lack of confidence and perfectionism. Further studies will have to clarify the respective roles of all these factors in order to better understand the multi-determined nature of checking. Memories for autobiographical actions will also have to be explored in a clinical population to find out whether these effects are maximised. Anyway, as our sample presented OCI-R checking scores similar to those of clinical groups (Foa et al., 2002), we cannot rule out the possibility that some of our participants already presented clinical OCD.

In conclusion, this study principally highlighted the lack of visual, kinaesthetic and spatial details in memories for actions, the observer perspective and the lack of memory confidence that characterise checkers. These results support the idea that checking-prone participants have impersonal memories for actions, which may explain why they find it problematic to be sure of whether they really performed an action or only imagined it. We also showed that anxiety played an important role in our results and that further work is needed to see to what extent it could explain checkers' memory difficulties. Taken as a whole, these outcomes represent an important step in the study of the mechanisms underlying checking.

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