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An experimental re-examination of the inferential confusion hypothesis of obsessive–compulsive doubt

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ABSTRACT

Background and objectives: The inferential confusion hypothesis postulates that obsessive doubt is perpetuated by a subjective form of reasoning characterized primarily by a distrust of reality and an overreliance on imagined possibilities. However, experimental evidence for this hypothesis may be compromised by a potential confound between type of information (reality vs. possibility) and its valence (danger vs. safety). In the present study we aimed to untangle this potential confound.
Methods: Forty OCD and 40 non-clinical participants underwent two versions of the Inferential Processes Task (Aardema, F., et al. (2009). The quantification of doubt in obsessive–compulsive disorder. International Journal of Cognitive Therapy, 2, 188–205). In the original version, the reality-based information is congruent with the safety hypothesis, whereas the possibility-based information is congruent with the danger hypothesis. In the modified version incorporated in the present study, the reality-based information is congruent with the danger hypothesis, whereas the possibility-based information is congruent with the safety hypothesis.
Results: Our findings did not support the inferential confusion hypothesis: both OCD and control participants changed their estimations of the probability of unwanted events based on the type of information they received (whether it conveyed danger or safety) regardless of whether it was framed as reality or possibility.
Limitations: The design of the present study does not lend itself to examining alternative explanations for the persistence of doubt in OCD.
Conclusions: The hypothesized inferential confusion in OCD requires further validation. It is particularly important to demonstrate that findings do not reflect a prudential reasoning strategy.

1. Introduction

Obsessive–compulsive disorder (OCD) is characterized by frequent obsessions and compulsions with a debilitating effect on overall functioning and well-being. OCD is often referred to as “the doubting disease” (Janet, 1903) because obsessions tend to take the form of a doubt, such as “I might have left the stove on” or “I might be contaminated”. In order to decrease the distress caused by the doubt, individuals with OCD employ various forms of compulsive behavior, such as checking, mental reconstruction, or obtaining reassurance from others. Because of its central role in OCD, researchers have examined various aspects of obsessive doubt, including its scope and its underlying mechanisms. This research shows that doubt is not limited to typical OCD concerns but may be quite general. People with OCD often doubt their memory (e.g., Brown, Kosslyn, Breitler, Baer, & Jenike, 1994; Constans, Foa, Franklin, & Mathews, 1995; Cougle, Salkovskis, & Wahl, 2007; Dar, Rish, Hermesh, Fux, & Taub, 2000; MacDonald, Anthony, MacLeod, & Richter, 1997; McNally & Kohlbeck, 1993; Tolin et al., 2001) and related capacities such as decision-making and concentration abilities (Nedeljkovic & Kyrios, 2007; Nedeljkovic, Moulding, Kyrios, & Doron, 2009). Other studies have shown that obsessive–compulsive (OC) individuals also distrust their attention, perception and senses (Aardema, O'Connor, & Emmelkamp, 2006; Hermans et al., 2008; Hermans, Martens, De Cort, Pieters, & Eelen,

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2003; van den Hout, Engelhard, de Boer, du Bois, & Dek, 2008; van den Hout et al., 2009). More recent studies have shown that OC tendencies are associated with doubt in regard to internal states such as relaxation and muscle tension (Lazarov, Dar, Oded, & Liberman, 2010; Lazarov, Dar, Liberman, & Oded, 2012a, 2012b).

Research into the underlying mechanism of obsessional doubt demonstrated that compulsive behaviors, and especially checking, only increase obsessional doubt, leading to a vicious cycle of more checking and more doubting (e.g., Ashbaugh & Radomsky, 2007; van den Hout & Kindt, 2003, 2004). However, not much is known about why obsessional doubts are maintained despite ample evidence that contradicts them. For example, why does the person with OCD doubt that the door is locked even though s/he standing right in front of it? One theory which attempts to explain this striking feature of OCD is the *inference based approach* (IBA; O'Connor, Aardema, & Pélissier, 2005), which postulates that a central cognitive factor in OCD is *inferential confusion* (Aardema & O'Connor, 2003, 2007; O'Connor & Robillard, 1995, 1999). Inferential confusion represents a failure to recognize the unrealistic nature of the obsession due to a subjective form of reasoning characterized primarily by a distrust of the senses and an overreliance on possibility or imagination. According to this model, the obsessive person in the above example doubts that the door is locked due to over-reliance on possibilities that support the idea that the door might nevertheless be open (e.g., maybe I did not turn the lock sufficiently; Aardema, O'Connor, Pélissier, & Lavoie, 2009). More generally, the inferential confusion theory states that "people with OCD distrust reality–the world of the senses–and favor subjective possibilities that negate the senses" (Aardema et al., 2009, p. 189).

Aardema et al. (2009) emphasize that inferential confusion has to be distinguished from threat-related appraisals. Although obsessions often develop in relation to danger, what is specific to OCD according to the IBA is the cognitive process, i.e., the element of inferential confusion ("e.g., I might be in danger … even though I see and sense nothing to support it;" Aardema et al., p. 189). The authors support this claim by citing studies in which inferential confusion, as assessed by the Inferential Confusion Questionnaire (Aardema, O'Connor, Emmelkamp, Marchand, & Todorov, 2005) was independently related to obsessive–compulsive symptoms while controlling for overestimation of threat and responsibility (Aardema et al., 2006; Aardema, Radomsky, O'Connor, & Julien, 2008). It is still possible, however, that the apparent failure of people with OCD to let go of doubts that concern danger (e.g., the door might not be properly locked) is not a result of a general problem in their cognitive processes but rather reflects a "better safe than sorry" policy. In other words, persistent doubt in the face of threat might reflect *prudential reasoning* rather than inferential confusion.

In general, the prudential reasoning hypothesis states that in the face of threat people tend to use a prudential reasoning strategy (e.g., de Jong, Haenen, Schmidt, & Mayer, 1998; Smeets, de Jong, & Mayer, 2000). This strategy entails focusing on and confirming the worst hypothesis, and then reiterating the testing process; thus, it tends to lead to confirmation of the danger hypothesis and disconfirmation of the safety hypothesis (Jonson-Laird, Mancini & Gangemi, 2006; Mancini & Gangemi, 2004a). This prudential strategy is especially relevant to anxiety disorders, which are marked by intense emotional reaction to disorder-specific threats. For example, de Jong et al. (1998; de Jong, Mayer, & van den Hout, 1997; Smeets et al., 2000) found that individuals with hypochondriasis are more likely to selectively search for confirming information when asked to judge the validity of a danger conditional hypothesis in the context of health threats (e.g., If a person suffers from a headache, then that person has a brain tumor). The threat can also be related to guilt and responsibility, which are central features of OCD (Arntz, Voncken, & Goosen, 2007; Mancini & Gangemi, 2004a, 2011; Niler & Beck, 1989; Rachman, 1993; Salkovskis, 1985; Salkovskis & Forrester, 2002; Van Oppen & Arntz, 1994). Specifically, studies have demonstrated that people check safety and danger hypotheses related to the outcome for which they feel responsible more prudently than subjects who are not made to feel responsible (e.g., Mancini & Gangemi, 2004a, 2004b, 2006). The persistent doubt in OCD (e.g., is the door really locked?) could therefore result from the motivation to minimize the possibility of being responsible and/or feeling guilty, which would lead to a prudential reasoning strategy, rather than from any general disorder in inferential reasoning.

The present study aimed to re-examine the conclusions of a recent experimental study by Aardema et al. (2009) that was interpreted as supporting the inferential confusion hypothesis. The original study employed a new inference process task (IPT), in which participants were presented with two hypothetical written scenarios leading up to an inference (see Table 1). The first scenario was a semi-typical OCD-related narrative presenting the possibility that the protagonist of the story may have caused an accident while driving a car across a busy intersection (accident scenario). The second scenario was a non-OCD-related narrative presenting the possibility of a bus strike while waiting for a bus (bus strike scenario).

Participants were alternately presented with possibility- and reality-based information (Tables 2 and 3) in relation to the doubt induced by the two scenarios. Following each presentation, participants rated the probability that the event referred to in the scenario (accident, bus strike) has occurred. Aardema et al. (2009) found that participants with OCD were similarly affected by reality-based information as non-clinical controls, but more influenced by possibility-based information, leading to higher levels of doubt. However, in the original version of the IPT, reality-based information was always congruent with the idea that no accident/no bus strike had happened (i.e., the safety hypothesis), whereas the possibility-based information was always congruent with the idea that a car accident/bus strike had happened (i.e., the danger hypothesis; see Tables 2 and 3). Because of this confound, the effects of possibility on the subjective probability that the event has happened (which is the authors' operationalization of doubt) cannot be separated from the effect of danger information.

Table 1
The two scenarios of the IPT (from Aardema et al., 2009).

OCD-relevant scenario	Non OCD- relevant scenario
You're on your way to work with the car. This morning you read about an accident where a truck driver unknowingly drove over someone, and left the scene of the accident without realizing. You wonder how it is possible that someone could not notice this while driving. As you drive along, you come across an intersection and come to a halt at the stoplight. It is quite busy, with a lot of people on the other side of the intersection waiting to cross the street. You notice a group of young people, boys and girls, chasing each other, running on and off the street. As the light turns green you start to accelerate. Then, just as you pass the intersection you hear a scream and feel a bump!	You are on your way to a restaurant for an evening out with your friends. You have decided to take the bus to save some money even though the possibility of a bus strike was announced on the news yesterday. Once you arrive at the bus stop you wait for 20 min with several people standing beside you and still no bus has arrived. Then you overhear something about "a strike." Soon afterward most of the people around you disappear.

Table 2
Pairs of reality- and possibility-based information in the OCD relevant scenario used in the original and modified version of the IPT.

Type of information (R = reality; P = possibility)	IPT – original version	IPT – modified version
R1	"You look in the rear-view mirror and see a pothole in the road."	"You look in the rear-view mirror and don't see any pothole in the road.
P1	"The pothole may not have been deep enough to cause the bump."	"The pothole may not be easily visible from the rear-view."
R2	"You turn your head and see no one lying on the street."	"You turn your head and see a person that is bending down in the street."
P2	"You may not have seen everything, because it's quite crowded".	"You may not have seen well, because it's quite crowded."
R3	"You watch the expressions on people's faces and see no emotion that might indicate an accident."	"You watch the expressions on people's faces and see they are upset."
P3	"The lack of expression in people's faces may have been shock."	"The upset expressions on people's faces may be due to the stress for the frantic traffic."

Therefore, the results of the original study can be interpreted also in terms of the prudential reasoning hypothesis, i.e., that OCD participants were more affected than control participants by information that conveyed danger.

In the present study, we disentangled the two variables that were confounded in the original Aardema et al. (2009) study by using two versions of the ITP, the original version described above and a modified version (Tables 2 and 3). In contrast to the original version, in the modified version the possibility-based information is always congruent with the safety hypothesis (e.g., *the car accident did not occur; there was no bus strike*), whereas the reality-based information is always congruent with the danger hypothesis (e.g., *the car accident occurred; there was a bus strike*) (see Tables 2 and 3).

This design allows a clear separation of the prediction of the inferential confusion hypothesis from those of the prudential reasoning hypothesis. The inferential confusion hypothesis would predict that regardless of the valence of the information, doubting in participants with OCD would be more affected by possibility-based information than by reality based information. In contrast, the prudential reasoning hypothesis, which we favor, would predict that doubting in OCD participants would be affected by the valence of the information (danger vs. safety), regardless of whether it is presented in the form of possibility- or reality-based information. As in the original study, doubt was defined as the possibility that the negative outcome (accident, bus strike) did occur, and the performance of people with OCD was compared to that of control participants with no psychiatric diagnosis.

2. Methods

2.1. Participants

The OCD group consisted of 40 patients (21 men, 19 women) with a mean age of 32.62 years (SD = 5.90, range 21–42 years) treated at the Centre for Cognitive Psychotherapy in Rome. The OCD participants were recruited during the assessment phase, just before starting their treatment at the Centre. Diagnoses were established with the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996). Eight patients (40%) presented with OCD as a sole diagnosis and 12 patients (60%) presented with one comorbid condition: Six patients suffered from major depression and five anxiety disorders (two patients with social phobia, two with panic disorder without agoraphobia, one with generalized anxiety disorder and one with anorexia nervosa). The non-clinical group consisted of 40 participants (18 men, 22 women) with a mean age of 34.8 years (SD = 7.70, range 26–54 years) screened using an abbreviated SCID interview to ascertain that they did not meet criteria for any past or present mental disorders. Participants in the non-clinical group were recruited from several sites (university students, working population) via advertising, as well as announcements on the public boards of Messina University. There were no differences between the OCD and control groups in regards to sex (χ^2 (1, 81) = 0.45, p = 0.5), age ($t(78) = 1.42$, p = 0.15) or education level (OCD participants: M = 13.9 years, SD = 0.95; non-clinical participants: M = 13.7 years, SD = 0.87, $t(78)$ = 1.01, p = .32). All participants provided written informed consent.

2.2. Measures

2.2.1. Inferential confusion questionnaire-expanded version (ICQ-EV; Aardema et al., 2010)

The ICQ-EV is a 30-item questionnaire that measures the predisposition to negate reality in favor of a hypothetical possibility by asking participants to rate items, such as "*I often know a problem exists even though I don't have visible proof*" and "*I am sometimes more convinced about what might be there than by what I actually see*", on a 6-point scale (1 = strongly disagree to 6 = strongly agree).

Table 3
Pairs of reality- and possibility-based information in the non-clinical relevant scenario used in the original and modified version of the IPT.

Type of information (R = reality; P = possibility)	IPT – original version	IPT – modified version
R1	"At the end of the street you see a bus driving on what appears to be a different route."	"At the end of the street you don't see any bus driving on your direction."
P1	"Maybe the bus was out of service since you could not see whether there were any people in it."	"Maybe the bus left the terminal late.
R2	"A person tells you he took the bus earlier in the day."	"A person tells you he took the motorbike because after 20 min' wait the bus was not arrived yet.
P2	"The strike may have only started later in the day."	"Maybe that person was in a hurry that day, and so he did not want to wait.
R3	"You call the information service and get an automated message with no mention of any strike."	"You call the information service and get an automated message with a mention of a possibility of a strike."
P3	"Maybe the bus company doesn't give out this type of information that quickly."	"Maybe the bus company doesn't update the automated messages and gives always mention of a possibility of a strike, just to avoid complaints.

OCD participants were shown to score significantly higher on this scale than healthy controls or participants with other anxiety disorders. The ICQ-EV was shown to be a highly reliable measure ($\alpha = 0.96$ in the OCD group; Aardema et al., 2010). The internal consistency for the scale was high in the current sample as well ($\alpha = 0.94$).

2.2.2. Padua Inventory-revised

The revised version of the Padua Inventory (PI-R; van Oppen, Hoekstra, & Emmelkamp, 1995) consists of 41 items rated on a 5-point scale according to the degree of disturbance caused by a thought or behavior (0 = not at all to 4 = very much). The PI-R gives a total score (from 0 to 164) indicating the presence of obsessive–compulsive features, and five sub-scale scores: impulses (e.g., "While driving I sometimes feel an impulse to drive the car into someone or something"), washing (e.g., "I feel my hands are dirty when I touch money"), checking (e.g., "I check letters carefully many times before posting them"), rumination (e.g., "I find it difficult to make decisions, even about unimportant matters"), and precision (e.g., "I feel obliged to follow a particular order in dressing, undressing, and washing myself"). The PI-R shows good internal consistency ($\alpha = 0.77$–0.93 in the OCD sample; van Oppen et al., 1995). The internal consistency for the scale in the current study was high as well ($\alpha = 0.89$).

2.2.3. Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Garbin, 1988) consists of 21 items used to assess the severity of depressive symptoms experienced during the 2 weeks prior to completion on a Likert-type scale (0–3). The range of scores is 0–63. The scale is a reliable ($\alpha = 0.92$) and valid measure (Beck et al., 1988). It showed a high internal consistency also in our sample ($\alpha = 0.90$).

2.2.4. Trait Anxiety Inventory

On the Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) respondents are asked to rate how often they "generally" feel in regard to 10 self-descriptive statements using a 4-point scale (1 = almost never, 4 = almost always). The internal consistency for the scale was 0.90 in the original study as well as in the present one.

2.3. Procedure

Participants within each group were randomly assigned to the original or the modified version of the IPT, so that 20 participants from each group were presented with the each version of the IPT. With both versions of the IPT, participants were presented with two written scenarios leading to a particular inference. The first scenario was an OCD-related narrative (accident scenario) and the second scenario was a non-OCD-related narrative (bus strike scenario; see Table 1). After reading each scenario the participants were asked to rate how anxious they would feel if the scenario really occurred (*How anxious would you feel in the above situation?)* using a 100 mm visual analogs scale with the anchors "not at all anxious" on the left and "extremely anxious" on the right. Next, participants had to rate the probability that the negative event (accident/bus strike) had occurred using a similar scale with the anchors "totally improbable" on the left and "totally probable" on the right. Following this baseline assessment, participants were alternately presented with pieces of reality-based and possibility-based information. For example, with the OCD-relevant scenario, participants were shown a piece of reality-based information congruent with the idea that an accident occurred (R1, Table 2) and then asked to rate the probability that an accident occurred. Next, participants were presented a new piece of possibility-based information potentially falsifying the previous piece of reality-based information (P1, Table 2) and were again asked to rate the probability that an accident occurred. This procedure was repeated for the subsequent pairs of reality- and possibility-based information (R2, P2, R3, P3 – see Table 2). The order of the three reality–possibility pairs was counterbalanced between participants, resulting in six separate versions of the questionnaire. The same procedure was used for the non-OCD-relevant scenario (Table 3).

3. Results

As shown in Table 4, the differences in mean scores to the clinical inventories between the patient and control groups were significant. The OCD group reported higher scores in all clinical measures compared to the non-clinical group.

Figs. 1 and 2 show the effects of sequential reality- and possibility-based pieces of information on estimated probabilities of accident and bus strike, respectively, with the original and modified IPT. We calculated the mean impact of reality- and possibility-based pieces of information for each participant within each condition as follows: $\text{Mean}_{\text{reality}} = ((R1 - B) + (R2 - P1) + (R3 - P2))/3$; $\text{Mean}_{\text{possibility}} = ((P1 - R1) + (P2 - R2) + (P3 - R3))/3$. Figs. 3 and 4 show these mean effects of reality and possibility with the two versions of the IPT. As Figs. 1–4 illustrate, the effects of possibility and reality were reversed in the modified as compared to the original IPT with both scenarios, as predicted. To examine the statistical significance of this pattern, we conducted a $2 \times 2 \times 2$ mixed model ANOVA with estimated probability of the negative event as the dependent measure and with Type of Information (reality vs possibility), IPT Version (original vs. modified) and Group (OCD vs. non-clinical) as the independent variables. This analysis was conducted separately for the accident scenario and the bus strike scenario.

Starting with the accident scenario, there was a main effect of Type, $F(1, 76) = 13.21$; $p < .001$. An examination of the means showed that across groups and IPT versions, possibility-based information increased the estimated probability of an accident occurring whereas reality-based information decreased it. There was also a large Type × IPT version interaction, $F(1, 76) = 79.04$; $p < .001$, which confirms the observation that the effects of possibility- and reality-based information were reversed in the modified as compared to the original IPT. However, the Type × Group interaction predicted by the inferential confusion hypothesis (i.e., that OCD participants would be relatively more influenced by possibility-based information compared to non-clinical participants) was not found, $F(1, 76) = 1.03$; $p = .31$. Instead, there was a sizable interaction between Group and ITP version, $F(1, 76) = 35.14$;

Table 4
Mean scores and standard deviations on questionnaire measures in the OCD group and nonclinical control group.

	OCD group		Non-clinical group		T[a]
	Mean	SD	Mean	SD	
Padua Inventory Revised	57.56	17.54	16.90	12.85	11.83
Impulses	7	3.86	.67	1.18	9.91
Washing	14.62	9.88	3.82	5.36	6.07
Checking	11.97	8.07	5.43	5.41	4.26
Rumination	22.97	8.75	5.07	4.65	11.42
Precision	3.6	3.46	.98	1.47	4.40
Inferential Confusion Questionnaire	112.90	27.97	72.86	16.81	7.76
Beck Depression Inventory	20.36	8.59	5.48	3.3	10.23
Trait STAI	57.21	7.1	36.83	7.4	12.57

[a] All $p < .001$.

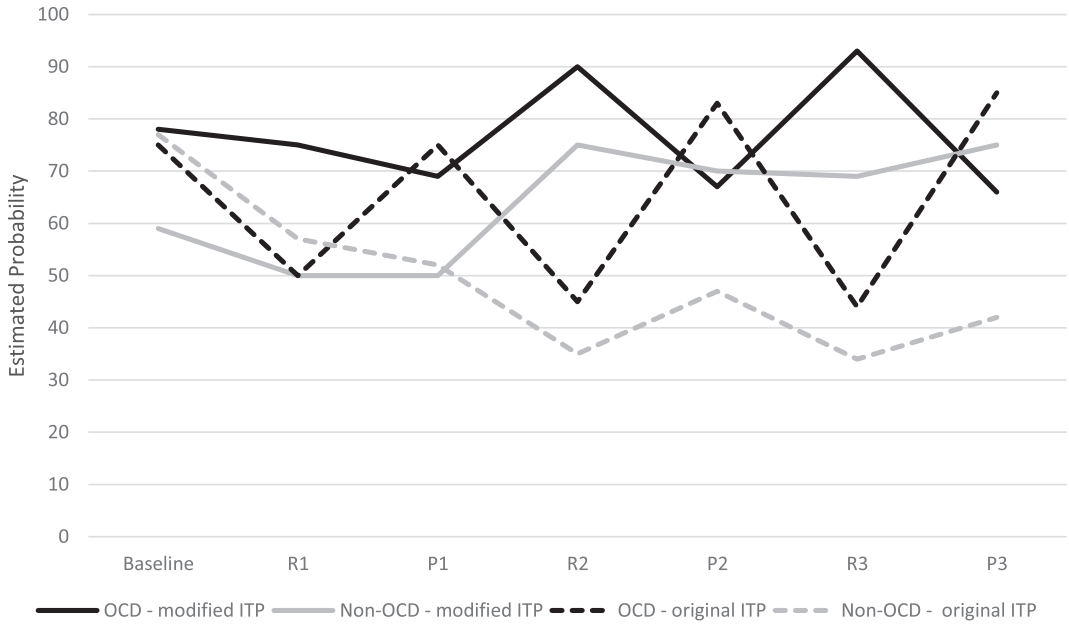

Fig. 1. Effects of sequential reality- and possibility-based pieces of information on estimated probability of an accident with the original and modified ITP.

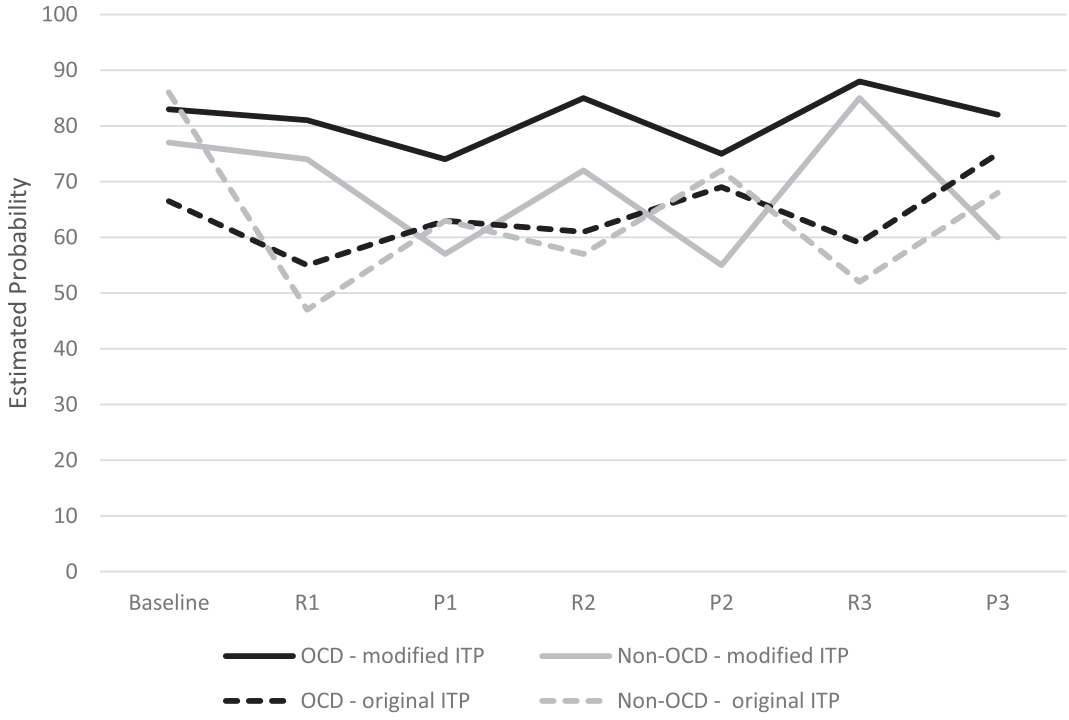

Fig. 2. Effects of sequential reality- and possibility-based pieces of information on estimated probability of a bus strike with the original and modified ITP.

$p < .001$. An examination of Fig. 3 shows that this interaction reflects a larger effect overall (across type of information) of the original IPT (vs. the modified version) in the Non-clinical as compared to the OCD participants. This effect is largely due to the relatively big difference between possibility- and reality-based information in the original ITP on the non-clinical participants. More importantly, we found a substantial 3-way interaction between all three independent variables, $F(1, 76) = 25.88$; $p < .001$, which is attributable to the higher "amplitudes" of responses to both types of information in the OCD as compared to the non-clinical group, especially in the original version of the ITP. The main effect of Group was not significant, $F(1, 76) = 1.95$; $p = .17$.

The findings in relation to the bus strike scenario were somewhat different, but again fully in line with our predictions. Here there was no main effect of Type, $F(1, 76) = .36$; $p = .55$, but the large Type × IPT version interaction was replicated, $F(1, 76) = 48.84$; $p < .001$, again confirming that the effects of possibility- and reality-based information depended on the version of the IPT. Most importantly, the Type × Group interaction predicted by the inferential confusion hypothesis was completely absent, $F(1,$

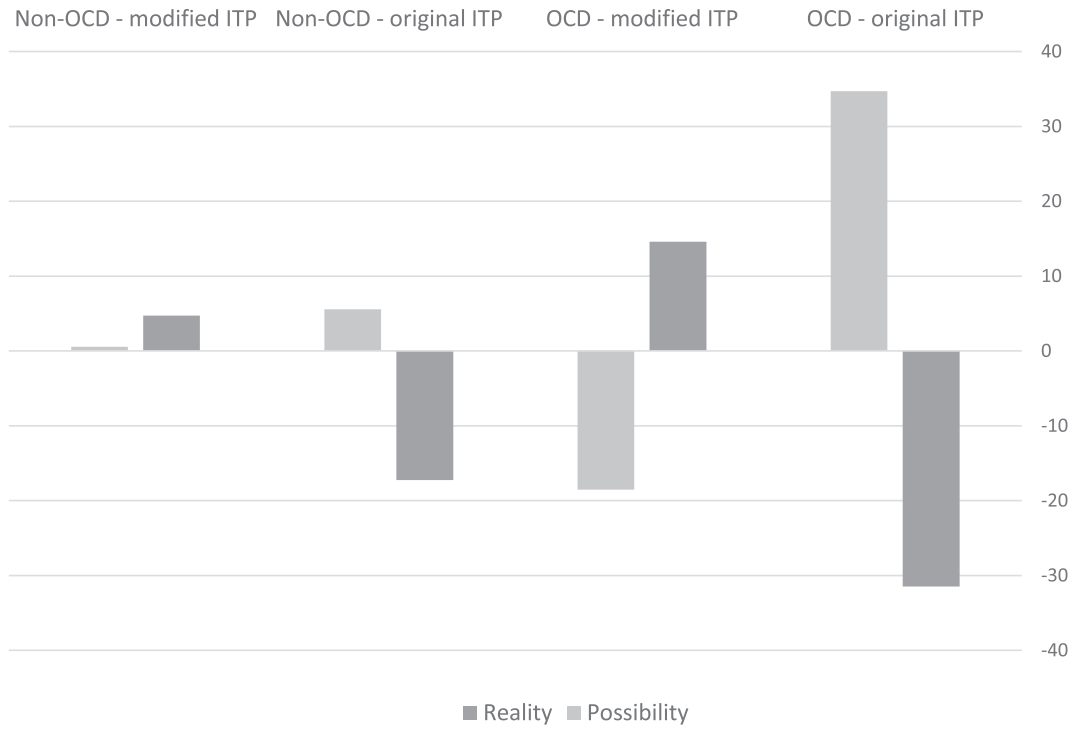

Fig. 3. Mean effects of reality- and possibility-based information on estimated probability of an accident with the original and modified ITP.

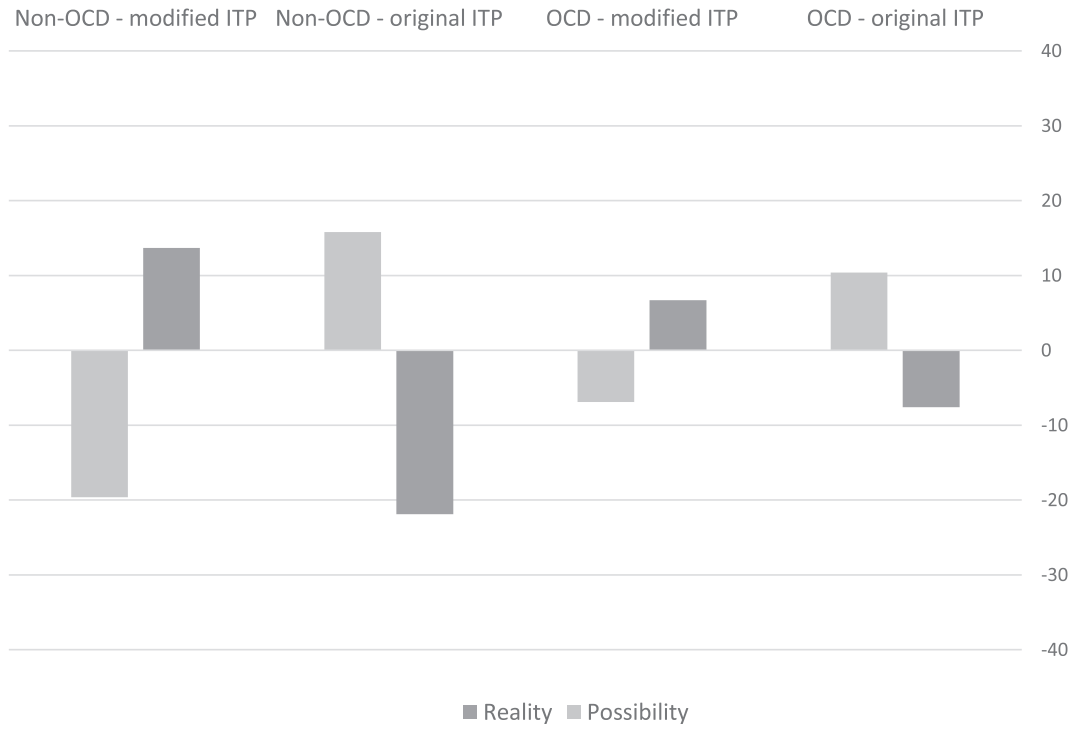

Fig. 4. Mean effects of reality- and possibility-based information on estimated probability of a bus strike with the original and modified ITP.

76) = 0.00; $p = .98$. In contrast to the accident scenario, the interaction between Group and ITP version was not significant, $F(1, 76) = .86$; $p = .36$, but the 3-way interaction between all three independent variables was, $F(1, 76) = 7.16$; $p = .009$. As Fig. 4 shows, this interaction reflects the finding that in this scenario, the probability estimations of non-clinical participants responded much more than those of OCD participants to both reality- and possibility-based information. Here, the main effect of Group was also significant, $F(1, 76) = 16.50$; $p < .001$, reflecting the fact that the overall effect of information reduced the probability estimations of non-clinical participants more than those of OCD participants.

A comparison between the results of the two scenarios (Fig. 3 vs. Fig. 4) suggests that OCD participants reacted more strongly than did the non-clinical participants to both reality- and possibility-based

information in the accident scenario, whereas the reverse pattern obtained in the bus strike scenario. To ascertain this observation, we calculated the absolute value of the impact of reality- and possibility-based pieces of information for each participant within each condition as follows: $Mean_{reality} = (|(R1 - B)| + |(R2 - P1)| + |(R3 - P2)|)/3$; $Mean_{possibility} = (|(P1 - R1)| + |(P2 - R2)| + |(P3 - R3)|)/3$. These indices reflect the "amplitude" of the reaction to reality- and possibility-based pieces of information, respectively. A mixed model ANOVA on these indices with Scenario and Group as independent variable confirmed the observation noted above: there was a significant interaction between the two variables, $F(1, 78) = 7.95$; $p = .006$. In addition, there was a main effect of scenario, $F(1, 78) = 11.47$; $p < .001$, indicating that the accident scenario, compared to the bus strike scenario, generated overall larger "amplitudes" of changes in estimated probability in reaction to both types of information across groups and IPT versions.

Following Aardema et al. (2009), we also examined the overall effect of the information by comparing the baseline (B) values with the last time point (P3) using repeated measures ANOVA. We conducted this analysis only for the OCD-relevant scenario, as the predicted differences between the groups suggested by the IBA were absent in the non-OCD scenario. This analysis revealed an interaction effect among time periods × groups × IPT versions, $F(1,76) = 35.15$, $p < .001$; partial eta squared = 0.32. This interaction effect remained significant when controlling for baseline anxiety, $F(1,75) = 22.98$; $p = .001$; partial eta squared = 0.24. In the original version of the IPT, the estimated probability of an accident decreased less in the OCD group than in the non-clinical control group following the three pairs of reality- and possibility-based information, replicating the finding of Aardema et al. (2009). In contrast, in the modified version of the task, control participants started off with lower probability estimates as compared to the OCD participants, and increased them gradually to a level similar to that of the OCD participants.

Finally, we calculated the correlations between the Inferential Confusion Questionnaire (ICQ) and the impact of reality and possibility information in the two scenarios (OCD and non-OCD) in both versions of the IPT and within each group. All the correlations were positive and ranged from 0.01 to 0.52, but due to the relatively small sample size, none were statistically significant after employing minimal compensation in alpha level to accommodate the large number of coefficients (16 coefficients, corrected alpha = .01). An examination of the coefficients did not reveal any clear pattern in relation to group or experimental condition.

4. Discussion

The present study aimed to re-examine the hypothesis that elevated doubt in OCD is due to inferential confusion, as hypothesized by O'Connor and colleagues (Aardema & O'Connor, 2003, 2007; O'Connor & Robillard, 1995, 1999). We used a modified version of the Inference Processes Task (IPT; Aardema et al., 2009) in order to disentangle a potential confound in the original task, in which possibility-based information was always congruent with the danger hypothesis whereas the reality-based information was always congruent with the safety hypothesis. In the modified IPT incorporated in the present study, the reality-based information was congruent with the danger hypothesis while the possibility-based information was congruent with the safety hypothesis. Our findings failed to support the inferential confusion hypothesis, which predicts that people with OCD would rely more on possibility-than on reality-based information in judging the probability of negative events. In our study both OCD and control participants changed their estimations of the probability of the unwanted event based on the type of information they received (whether it conveyed danger or safety) regardless of whether it was framed as reality or possibility.

We should note that recent results of Aardema and colleagues also appear to provide little support for the inferential confusion model. Aardema and O'Connor (2012) examined the utility of Inference Based Therapy (IBT), which is based on the inferential confusion model, for individuals with OCD. The authors found that IBT improved participants' ability to resolve obsessional doubt, which was also associated with better treatment outcome. However, the treatment reduced the impact of both possibility and reality information; in fact, only the latter effect was statistically significant. These findings suggest that IBT was effective not by correcting the hypothesized inferential confusion bias, but by reducing the overall impact of information on danger assessment.

As noted in the Introduction, one alternative account of the persistence of doubt in OCD in the face of safety information (e.g., the door seems to be locked) would be to postulate reliance on a prudential reasoning strategy. According to this hypothesis, fear of making a mistake may bias people to adopt a "better safe than sorry" strategy that would lead them to seek and trust information that confirms the danger in preference to the safety hypothesis. This type of bias would be consistent with the reluctance of OC individual to relax their concerns even in the face of reassuring evidence. In the present study we did not observe any evidence for prudential reasoning in our OCD participants – their estimation of danger changed to a similar degree (though in opposite directions) in response to safety and danger information. The IPT, however, is not ideally suited for detecting reliance on a prudential strategy, as it does not assess the process of searching for information or of selecting between various types of information. Future studies may directly examine whether people with OCD indeed use a prudential strategy by adopting more appropriate paradigms, such as those used by Smeets et al. (2000) and Mancini and Gangemi (2006).

An interesting findings that emerged from the present study is related to the difference between the two scenarios. In the OCD-relevant scenario (the car accident) OCD participants showed higher "amplitudes" in their reactions to both danger and safety information as compared to the control participants, whereas the opposite was the case for the non-OCD-related scenario (the bus strike). This pattern of results supports the domain-specific approaches to OCD (e.g. Aardema et al., 2009; Johnson-Laird et al., 2006), especially those that postulate that people with this disorder are primarily concerned with events that involve personal responsibility and/or guilt (e.g., Arntz et al., 2007; Mancini & Gangemi, 2004a, 2006; 2011; Shapiro & Stewart, 2011). Whereas the possibility of causing a car accident clearly provokes these types of concerns, the possibility of a bus strike does not. It appears that in the latter case, the impact of both safety and danger information was greatly attenuated in the OCD participants. This result might suggest a lack of personal interest in the probability of this type of event, which involves no personal agency, and therefore no responsibility or potential guilt on the part of the protagonist.

In our study, as in previous studies, OCD participants scored higher than control participants on the Inferential Confusion Questionnaire. While this finding is consistent with the IBA, our results suggest caution in interpreting this finding. Specifically, most items on the ICQ may reflect prudential reasoning rather than inferential confusion. Several items in the ICQ-EV explicitly limit the domain of confusion to negative possibilities (e.g., "I sometimes invent stories about certain problems that might be there without paying attention to what I actually see"). Other items do not contain this potential confound, but endorsement may still reflect prudential reasoning. For example, when responders endorse the item "I am sometimes more convinced about what might be there than by what I actually see," the examples they have in mind might be

those that involve potential danger. We should emphasize that this hypothesis concerning the ICQ is speculative and may be tested empirically in future studies by including items with explicitly positive valence, such as hoped-for scenarios. If endorsement of such items is still associated with OCD, this would provide stronger support the inferential confusion model.

We should emphasize that our findings do not (and were not aimed to) falsify the Inferential Confusion hypothesis of OCD. We do believe, however, that they call for a refinement of the IBA that would incorporate the valence of information as an essential factor in the model. It would be important in future work to delineate the differences between the predictions of the IBA and those of alternative models, particularly those of the prudential reasoning hypothesis.

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