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An experimental analysis of obsessive-compulsive checking as avoidance behaviour

Luis Valero Aguayo[1], Félix Hurtado Melero[2] and Aurora Gavino Lázaro[1]
[1] Universidad de Málaga and [2] Servicio Andaluz de Salud (Cádiz)

Abstract

Background: Many explanatory models of obsessive-compulsive disorders (OCD) support the idea that compulsive behaviours are an attempt to avoid an aversive situation. There are few experimental studies carried out on the onset of repetitive behaviours. This study tries to create a repetitive checking behaviour as an analogue explaining similar OCD behaviours. **Method:** An inter-group design with 3 levels of aversion (minimal, progressive and maximum) in a visuo-spatial reasoning task was used. 48 university students without OCD problems (mean= 23 years old) were the participants, randomly distributed in 16 per group. Checking frequency (semi-hidden chronometer) for each task was measured and the questionnaires TONI-2, STAI, MOCI and YBOCS-SR were applied. **Results:** Participants with a minimal or maximum level difficulty showed a significantly higher level of checking behaviour than those in the progressive difficulty. The differences occurred between the minimal and the progressive group, and between the minimal and maximum difficulty. There were no differences in any other variable. **Conclusion:** In this analogue, the continuous checking of a chronometer was reinforced by the elimination of boring tasks. The momentary escape from an aversive situation explains the checking behaviour. This study could be an experimental analogue of checking behaviour, showing its avoidance function.

Keywords: OCD, checking, experimental analogue, avoidance, negative reinforcement.

Resumen

Un análisis experimental de la comprobación obsesivo-compulsiva como conducta de evitación. **Antecedentes:** múltiples modelos explicativos sobre los trastornos obsesivo compulsivos (TOC) apoyan la idea de que las conductas compulsivas son un intento de eliminar una situación aversiva. Hay pocos estudios experimentales sobre cómo aparecen las conductas repetitivas. Este estudio intenta crear una conducta de comprobación repetitiva como un análogo que podría explicar conductas TOC similares. **Método:** se ha utilizado un diseño entregrupos con 3 niveles de aversión (mínimo, progresivo y máximo) en una tarea de razonamiento viso-espacial. Han participado 48 estudiantes universitarios sin problemas TOC (media= 23 años), aleatorizados 16 por grupo. Se ha medido la frecuencia de comprobaciones (cronómetro semioculto) en cada tarea y se aplicaron los cuestionarios TONI-2, STAI, MOCI y YBOCS-SR. **Resultados:** los participantes con dificultad mínima o máxima mostraron significativamente más respuestas de comprobación que el grupo de dificultad progresiva. Las diferencias ocurrieron entre el grupo con tarea de dificultad mínima y progresiva, y mínima frente a máxima. No hubo diferencias en ninguna de las otras variables. **Conclusiones:** en este análogo la comprobación continua se vería reforzada negativamente al aliviar una tarea monótona, el propio escape momentáneo explicaría la comprobación. Este estudio podría ser un análogo experimental de que las conductas de comprobación tienen una función de evitación.

Palabras clave: TOC, comprobación, análogo experimental, evitación, reforzamiento negativo.

Obsessive-compulsive disorders (OCD) affect between 1.9 and 2.5% of the world population at some point in their lives, creating great difficulties on a professional, academic and social level (DSM-IV-TR, 2001; Eisen et al., 2006; Weissman, Bland, Camino, & Greenwald, 1994). The disorder usually starts at an average age of between 22 and 35 years, with 65% of cases starting before the age of 25, while only 15% start after the age of 35 (Rasmussen & Eisen, 1990; Weismann et al., 1994). The disorder is characterized by the appearance of intrusive thoughts, which in turn create discomfort, and by repetitive behaviour, which is carried out with the intention of reducing the discomfort but which ends up increasing the appearance and intensity of obsessive thoughts (DSM-IV-TR, 2001). Since the first studies of OCD emerged, a range of different classifications has been created to describe the nature of obsessive thoughts. These include fear of being infected, fear of hurting oneself or others, blasphemy and perfectionist ideals. The classifications have also been created concerning the nature of the compulsive behaviour, such as cleaning, checking, slowness, doubts, dwelling, etc. (Hodgson & Rachman 1977).

Various research projects have been carried out in the areas of psychopharmacology and neuro-ethology that empirically support different models of OCD in animals (Insel, Mos, & Oliver, 1994). Different repetitive behaviours in animals and the relation to cerebral zones were studied (Insel et al., 1994; Stein, Dodman, Borchelt, & Hollander, 1994; Winslow & Insel, 1991).

Received: January 9, 2013 • Accepted: September 24, 2013
Corresponding author: Luis Valero Aguayo
Facultad de Psicología
Universidad de Málaga
29071 Málaga (Spain)
e-mail: lvalero@uma.es

More specifically, experiments have been performed studying avoidance behaviour in animals. These studies have shown that the duration of the actual experiment can be used to manipulate the degree of aversion in the animal, so a reduction in the duration acts as a negative reinforcement (Mellitz, Hineline, Whitehouse, & Laurence, 1983). Houts (2005) reviewed these experimental procedures with animals, defending the use of classic concepts of avoidance learning formulation such as the Solomon model for creating OCD responses in animals.

Over the last three decades, research has also been conducted in an experimental context with humans. These studies have examined the relationship between certain variables (e.g., excessive responsibility) and the appearance, intensity and endurance of obsessive-compulsive symptoms. Different tasks were assigned to the participants in these experiments, whilst the participant's perceived responsibility for the task was manipulated and compulsive behaviour patterns were recorded (Bouchard, Rheaume, & Ladouceur, 1999; Lopatka & Rachman, 1995; Shafran, 2005). The OCD cognitive models also identify a fundamental role for stress, suggesting that compulsive behaviours are the result of attempting to confront a stressful situation, which paradoxically increases the frequency and intensity of the intrusive thoughts themselves. According to the cognitive models of OCD, the appearance of negative thoughts does not amount to the disorder per se, but rather it is the maladaptive interpretation of these thoughts that leads to the appearance of OCD (Rachman, 1997, 1998, 2002; Salkovskis, 1985; Salkovskis & Kirk, 1997). Other studies show that certain erroneous beliefs, such as an elevated feeling of responsibility or the need of thought control, are critical to the appearance and continuance of the disorder (Rachman, 1997), particularly as shown in the Ladouceur model of responsability (Arntz, Voncken, & Goosen, 2007; Ladouceur et al., 1995; Lopatka & Rachman, 1995). Some studies have tried to link the appearance of OCD with the occurrence of stressful life events prior to signs of the disorder. Specifically, an association has been found between traumatic life events and checking or compulsive hoarding (Cromer, Schmidt, & Murphy, 2007a, 2007b; Khanna, Rajendra, & Channabasavanna, 1988; McKeon, Roa, & Mann, 1984; Parkinson & Rachman, 1981). In contrast, the metacognitive model of OCD emphasizes the effect of three types of cognitions as the aetiology and maintenance of obsessive symptoms: thought fusion beliefs, beliefs about performing rituals and criteria about stopping rituals (Gwilliam, Wels, & Cartwirth-Hatton, 2005; Myers, Fisher, & Wells, 2009; Wells, 1997). However, this kind of study is correlated with questionnaires and rarely uses experimental designs in order to test these assumptions.

When addressing prolonged continuation of the disorder, there is abundant evidence showing that repetitive behaviour found in OCD receives negative reinforcement when the anxiety generated by the obsession diminishes. This idea arose in the first behaviour model of OCD, based on Mowrer's fear-avoidance model (Mowrer, 1960; Steketee & Frost, 1998). Rachman and Hodgson (1980) showed that the compulsive rituals in OCD patients were negatively reinforced when patients found that their anxiety was immediately diminished if they followed their rituals. In these experiments, the OCD patients were exposed to stimuli such as suspected infection and dirt, which, in turn, provoked great anxiety and the need to wash. Anxiety immediately diminished after the washing ritual was performed. This theory of compulsion as an avoidance strategy shares the same theoretical base with numerous functional analyses of avoidance in other anxiety disorders (Abramowitz & Moore, 2007; Barlow, 2002; Borkovec, Alcaine, & Behar, 2004; Price & Geer, 1972; Sturmey, 1996; Van Houten & Axelrod, 1993; Zvolensky, Lejuez, & Eifert, 2000).

The behaviour analysis of Hayes (Hayes et al., 1996; Hayes, Strosahl, & Wilson, 1999; Hayes & Lillis, 2012) presented a model of "emotional avoidance" for different psychopathological problems. Hayes proposes "experiential avoidance", the unwillingness to experience internal responses as the process of increasing a psychological problem through negative reinforcement. The simple pairing of an aversive external stimulus with a corresponding cognitive response, could lead to future negative emotional responses in the sole presence of that cognitive representation. Some individuals try to eliminate thoughts and sensations associated with these external events, and in this way some internal responses, such as distressing thoughts and feelings, may elicit behavioural avoidance.

The clinical data on people with OCD and checking shows that most checking occurs predominantly in the home when the person is alone, and also that checking increases when the person is depressed, or feels responsible for an act he or she avoids by checking (Rachman, 2002). This suggests an internal emotional state where the checking response could function as momentary avoidance.

Other authors propose different types of emotions to be eliminated as a mechanism that maintains OCD. For instance, Fiarbrother, Newth, and Rachman (2005) proposed the "mental pollution" (sensations of dirtiness without physical contact) and Olatunji (2010) the sensation of "disgust" as simple antecedent stimulation; Coles et al. (2005) and Leckman et al. (1994) proposed the feeling of "not just right" as the emotion the people want to eliminate, while Szechtman and Woody (2004) proposed "insecurity" as a mechanism for checking. It could be said that any mechanism which diminishes emotions, such as disgust or discomfort, may produce repetitive or compulsive behaviour. MacDonald and Davey (2005) also defended this idea, stating that any negative emotion could produce repetitive checking.

On the other hand, other studies have demonstrated the clinical usefulness of studying OCD in experimental virtual-contexts, testing directly the compulsive behaviours. An example is the experiment carried out by Kwanguk et al. (2008) in which the frequency and duration of the repetitive behaviour of checking in a virtual environment was recorded while the participants were exposed to that virtual world. Anxiety was the fundamental variable which differentiates OCD people from control groups in checking behavior.

This research intends to explore, in an experimental context, the possible appearance of the same kind of repetitive behaviour found in non-clinical people when exposed to an aversive situation. The intention is to identify if, when a possible aversive situation is created, a behaviour tendency for checking could occur as a way of avoiding the monotonous or difficult task. The aim is to create an experimental analogue, in a controlled situation, which simulates a possible functional explanation for the appearance of the repetitive checking behaviour, testing also the OCD and anxiety level before that situation.

Three experimental groups of university students were formed. They were given a monotonous task of visual-spatial reasoning

on a computer, using commercial software. Each group was given a different level of difficulty and the expected appearance and frequency of repetitive checking behaviour was registered. Three levels of difficulty were established: one group accomplished the task with the least level of difficulty, another with the maximum level of difficulty and a third group experienced a progressive increase in difficulty, which improved their ability to do the task as they progressed. The expected checking behaviour of the participants consisted in spontaneously looking at and checking the time on a chronometer that appeared in the background of the main task, in order to check the remaining time available to complete the task. To see the chronometer they had to press a key to make it visible. The specific objective was to test if a checking behaviour will emerge when the task had aversive characteristics, either because of monotony or difficulty. Checking the chronometer was not an instructed response or part of the principal task. It is possible that repetitive checking behaviour could occur and would increase depending on the aversive character of the task. In other words, they would have an avoidance function. In that case, the minimal difficulty level could produce boredom and monotony, which in turn may produce checking behaviour.

Method

Participants

Forty-eight university students participated in the experiment (12 men and 36 women, mean= 23 years old). The original number of participants was 50, although 2 were excluded from the study because they demonstrated parts of the exclusion criteria: (a) obtaining a score of 16 point on the YBOCS-SR which is in the OCD diagnostic cut-point (Steketee, Frost, & Bogart, 1996); and (b) presenting a high level of anxiety over 90% for the STAI (Spielberger, Gorsuch, & Lushene, 1994).

At the outset the 48 participants were distributed randomly into three experimental groups of 16: a minimal group, a progressive group and a maximum group. They gave their explicit consent to being video recorded during the sessions (without their faces appearing on the screen), and signed a consent form. They were also guaranteed total confidentiality with regard to all the information accumulated during the experiment.

Instruments

The main variables studied in this project are presented in this section, along with the instruments and materials used to carry out the experiments:

Visio-spatial reasoning task. The aim was to undertake a monotonous cognitive task using a videogame comprising different cognitive tasks. Brain Trainer v1.0® (MindSpace, 2007) was used for this purpose. One of the tasks is to recognise a cube amongst a variety of options, which are in a combination of colours. The participant has to choose the correct option, but the sides of the cube have been separated, therefore the cube is no longer in the shape of a cube. This programme was chosen because it allows us to grade the level of difficulty (the least difficult, the most difficult and progressive difficulty) and it also allows the experimental analogue task to be verified and tested for its possible learning efficiency. The videogame tells the player if they have succeeded or failed and every 10 attempts indicate the percentage rate of success in that block. Moreover, the game has been in fashion over the last few months, encouraging student participation and providing extra motivation for completing the experimental task.

Another piece of software used in creating the experimental framework was TimeLeft v. 3.42® (NesterSoft Inc, 2003), a piece of commercial software which projects a chronometer onto the computer screen. This large-scale chronometer partially shows the seconds ticking by while the participant is doing the task. The checking behaviour this project aimed to record during the experiment consisted of monitoring the number of times subjects checked the chronometer in order to check the time remaining until the end of the task.

To record the occurrence and frequency of the checking behaviour another piece of software, Golden Eye v. 4.11® (Monitoring-Spy-Software, 2002) was used. This application kept an exact record of the tasks on the computer, recording the frequency of the repetitive behaviour as well as the screen change times and the occasions when the participants did the task or checked the chronometer while they were doing the main task.

Both the experiment tasks and the result recordings were run onto a Toshiba Intel Core 2 a 3.66 MHz laptop computer connected to a Mitsubishi XD500U-ST light-projector over a 2×1.50 metre

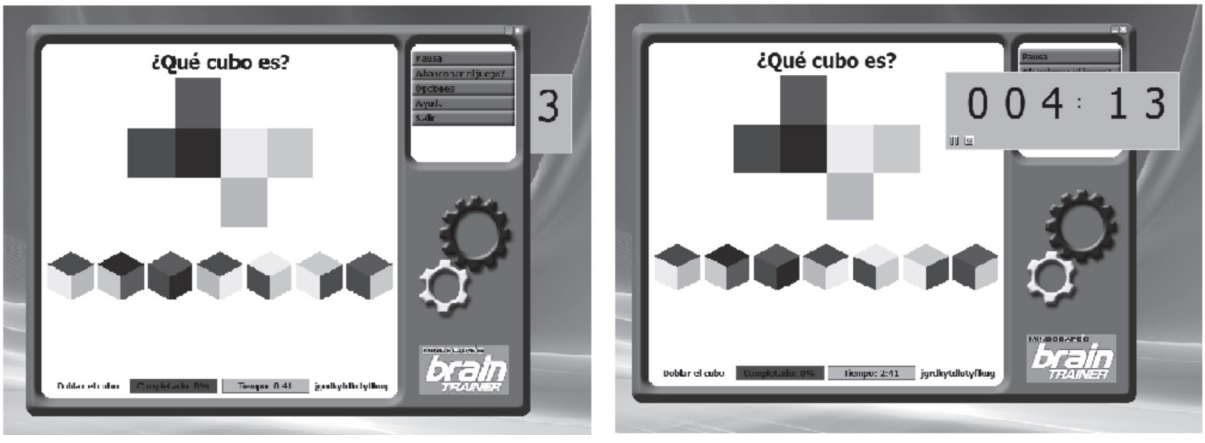

Figure 1. *Pictures of the screen of the visuo-spatial task and chronometer*

screen. The participant was seated 2.5 metres away from the screen and performed the task using a wireless mouse situated to their right on an adjacent table. A Sony DCR-SR32E digital video camera was also used to record each participant's performance during the task for further analysis and as a means of ensuring the reliability of the data obtained directly from the experiments and the computer recordings.

Obsessions and compulsions. To explore the possible presence of OCD symptoms in the participants, two instruments were used: the Yale-Brown Obsessive Compulsive Scale (YBOCS-SR; Steketee, Frost, & Bogart, 1996) and the Maudsley Obsessive Compulsive Inventory (MOCI) (Hodgson & Rachman, 1977).

The YBOCS-SR is a self-applied scale composed of two parts; the first part of the scale comprises a list of 58 obsessions and compulsions related to violence, aggression, religion and morals, with their corresponding examples. The person has to mark if they have (present scale) or have had (past scale) any of the obsessions. They should also mark the obsession that presently creates the most discomfort, as well as the compulsion they find themselves most obliged to do. The second part of the scale consists of 10 items (5 for obsessions and 5 for compulsions) by which the grade of discomfort, interference and resistance experienced by the subject can be evaluated in relation to the obsession and compulsions causing them the most discomfort. The scale shows a total score from which four additional scales can be taken: checking, cleaning and washing, slowness-repetition and doubt-meticulousness. The authors suggest that a person has OCD if they score 16 or over. The instrument has good validity with a high correlation with other scales from clinical studies (r >.86).

The Maudsley Obsessive Compulsive Inventory (Hodgson & Rachman, 1977) evaluates the presence, characteristics and gravity of obsessions and compulsions. It is a self-applied questionnaire consisting of 30 items with true or false answers and contains four subscales: checking, cleaning, repetition and doubt. The instrument's reliability is high, with Cronbach indices for the subscales that fluctuate between .70 and .80. The questionnaire shows a high correlation with other similar instruments.

Situational anxiety during the experiment. To measure the participant's anxiety levels during the experimental task the State/Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1994) was used. It is a test consisting of two parts, with 20 questions in each part. The first evaluates a transient emotional state, characterized by consciously perceived subjective feelings of attention and apprehension and by hyperactivity in the person's nervous system. The second part highlights relatively stable anxiety inclinations, which characterize individuals with a tendency towards perceiving situations as threatening. The instrument's reliability is high, with a co-efficiency of .94 for the first scale and .86 for the second. The STAI shows a high correlation with other similar instruments (r= .75 to.85).

The visuo-spatial reasoning ability. The visuo-spatial reasoning ability via the use of a standard non-verbal intelligence test was also measured using the Toni-2 Test of Nonverbal Intelligence (TONI-2; Brown, Sherbenou, & Johnsen, 1997). The instrument's psychometric characteristics are suitable, with a reliability of .90 and a validity co-efficiency superior to .35. The results from this instrument allowed us to study the relationship between the resolution capacity of these kinds of intelligence tests and the Brain Trainer's software performance.

Procedure

Prior to the outset of this research, a pilot study was carried out which served to explore the occurrence of repetitive behaviour and tested the experimental framework. This preliminary study involving 12 participants allowed the adjustment of the time duration of the visuo-spatial task; to select the visuo-spatial tasks with subjective evaluation of the aversive grade (easy, difficult, progressive).

In the experiment an inter-groups design with completely random participants was used. The group denominated as *minimal difficulty* did the easiest task, which was always and continuously on the program's lowest setting for visuo-spatial reasoning until the end of the session. The *progressive difficulty* group started on the lowest task level and as they got better, the task also got more difficult in blocks of 10 tries. The *maximum difficulty* group always started and continued on the maximum level of difficulty on the program, which required a lot of the participants' time and determination to get the reasoning solutions for each visual cube.

All the participants and groups were measured for the various OCD psychological variables, anxiety and visuo-spatial abilities, with the intention of relating the results to the reasoning and checking task results. They were given the opportunity to participate voluntarily in the experiment and were given only general information about the experiment. They were told that the team was investigating the usefulness of the mental entertainment computer programs and the learning phenomenon related to these programs. To assure participant motivation they were told that they would gain points towards their final grades in the subject. The experiment lasted approximately one and a half hours for each participant, and was divided into two parts in the following order: a) in the first phase, of approx.45 minutes, each person was told what their participation in the experiment would consist of. The procedure they had to follow in the visuo-spatial task was explained but the chronometer-checking test was not mentioned, even though the participants could see the chronometer on the screen. Subsequently, each person was assigned the following tests in the following order: TONI-2, STAI, MOCI and YBOCS-SR. b) In the second phase, a written description of how the Brain Trainer cube-recognition task should be done was given to each participant along with an example of the task. In the written instructions the participants were told that the chronometer on the screen indicated the elapsed time and the total task duration was 45 min. After this the researcher left the room leaving the video camera recording the screen (see Figure 1). At the same time the Golden Eye v. 4.11® secretly recorded the number of times that each person left the main task to check the remaining time until the end of the task. This phase of the experiment lasted 45 min. When the allotted time had elapsed the researcher returned, said good-bye and thanked the participant.

Following this, the percentage of correct and wrong answers for each person's Brain Trainer task were collected, along with the time it took them to complete the task and the number of times each person had shown checking behaviour.

Data analysis

In order to test the normality of data, a factor variance analysis was performed to measure the differences between the three groups' variables. Where there were statistical differences, a

post-hoc analysis was performed using the Sheffée and DMS test. Moreover, correlation tests were used to explore possible relations between questionnaires and variables. All the statistical tests were executed using the SPSS 17 program.

Results

A previous analysis was performed to verify if the variables age, gender, participant numbers and task time limits were homogeneously distributed between the groups. Although the number of female participants was greater than the number of males (36 women and 12 men) no significant difference existed in the distribution between the three experimental groups. Table 1 shows the mean scores of the different instruments used in the study for each experimental group.

The variance analysis revealed no significant statistical differences between the groups in the variables of anxiety, obsessions-compulsions and visuo-spatial reasoning. These results confirm no differences in anxiety when the participants face the visuo-spatial task, suggesting that anxiety does not influence results. There are also no differences in the OCD variables, as none of the groups had more extreme scores than the other groups. The data relating to task progression shows an increase in the number of correct answers with each block of 10 attempts, but there are no differences between the three groups' total correct answers' percentages or total time of task. The statistical analysis also revealed that a relationship does not exist between the variables gender and age and the number of checks registered. Confirmation of the difficulty and aversive character of the task was demonstrated through the statistical differences between groups regarding the number of attempts in each session (SC= 28.05, F= 12.39, gl= 2, p<.001). Notably there were differences between the maximum difficulty group and the minimum and progressive difficulty groups. The maximum difficulty group made fewer attempts in the same time because of the difficulty of the task.

A significant difference exists between the groups in relation to the fundamental variable: the number of checks behaviour (SC= 127.12, gl= 2, F= 4.56, p<.01). Figure 2 is a graph of the average number of checks made by the participants in the three groups.

Table 1
Mean scores for groups

	Minimal		Progressive		Maximum	
	M	**SD**	**M**	**SD**	**M**	**SD**
STAI-State	16.44	*7.35*	13.50	*7.63*	12.88	*7.91*
STAI-Trait	17.31	*11.11*	16.50	*8.95*	14.19	*6.39*
MOCI	5.63	*3.59*	4.56	*3.14*	5.31	*2.77*
YBOCS	4.74	*4.96*	5.88	*5.97*	4.25	*5.22*
Toni-2	36.19	*5.19*	36.44	*4.66*	38.44	*6.32*
Checking (**)	9.36	*3.09*	5.75	*4.35*	6.88	*3.63*
Time in minutes	44.96	*1.43*	46.39	*1.24*	45.92	*1.12*
Percentage of CR	59.37	*21.51*	68.31	*16.39*	55.28	*26.42*
Essays / Time (**)	3.74	*1.33*	3.03	*1.06*	1.85	*0.77*

(**) Checking responses and rate essays/time were significant (SC= 127.12, gl= 2, F= 4.56, p<.01)

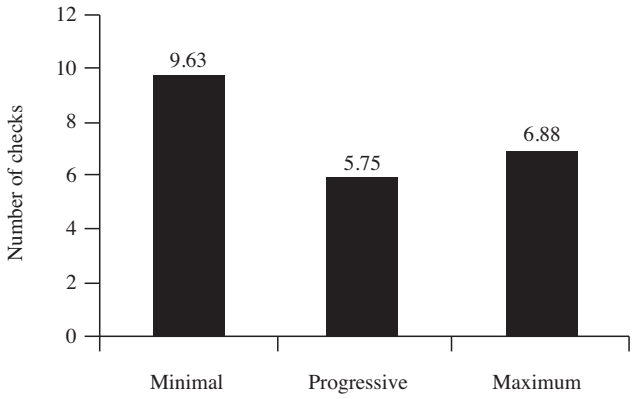

Figure 2. *Average checking responses for groups*

To study the diverse comparisons in pairs between the experimental groups a post-hoc analysis was performed with the Sheffée and DMS test. At a 95% level of confidence, the Scheffé test revealed that significant differences exist between the minimal difficulty group and the progressive group (Sf= 3.87, p<.01), but no significant differences existed between the minimal and maximum groups or between the progressive and maximum groups. However, the DMS test, which is the least demanding, revealed the existence of significant statistical differences between the minimal and progressive groups (DMS= 3.85, p<.01) and the minimal and maximum groups (DMS= 2.75, p<.05).

Subsequently, a correlation study was carried out which showed that correlation did not exist between the YBOCS or MOCI points and the resulting numbers for the checking responses. A high correlation was found between the instrument scores of OCD (r= .37, p<.001) and those obtained in the STAI (r= .33 and r= .42, p<.01). However, a correlation was not found between the number of checks and any of the different instruments, showing that these checks depend more on the task than on the participants' psychological characteristics.

Discussion

In accordance with the initial objectives, the minimum and maximum difficulty groups showed more repetitive checking responses. It could be said that the task performance in these groups would create a greater state of aversion than in the progressive group; in the minimum difficulty group because of the monotonous nature of the task and in the maximum difficulty group because of its difficult nature. The account of attempts in sessions of a similar time shows the differences in the aversive character of the task. In reality, the results showed the expected phenomenon of more checking, so it could be assumed that the task difficulty was maintained and increased the checking responses. However, the differences between the progressive and maximum groups were not so statistically significant, taking into account a high level of demand in the visuo-spatial test. It is possible that this intellectual task, although difficult, did not have aversive characteristics for this kind of participant. According to the researchers observing the sessions, the maximum difficulty group confronted the task as a goal because they perceived these psychological and intellectual tasks more as a challenge than as something aversive. This fact probably increased the participants'

task motivation and diminished the checking behaviour, so that although the maximum group did show more repetitive checking behaviour it was not significant enough to be conclusive.

On the other hand, as expected, significant differences were recorded between the minimal and progressive groups. The results show that a monotonous, repetitive task, which is aversive for the participants, produces a greater frequency of checking behaviour, thus confirming the analysis of the avoidance function of checking responses. It could be said that the data supports the idea that typical compulsive behaviour is maintained by negative reinforcement, as it allows the person to momentarily take their attention away from the aversive situation. This confirms the functional analysis of repetitive behaviour found in animals (Houts, 2005; Mowrer, 1960; Steketee & Frost, 1998). It is important to highlight the fact that instrument scores evaluating OCD or anxiety and the checking responses, do not show a correlation. This data supports the analysis that repetitive behaviour could be due to the grade of aversion to the task being accomplished and not to other personal variables, such as OCD symptoms or high anxiety. Here there is neither more anxiety nor obsessive thought in participants checking behaviour, primarily because they were randomly selected and not OCD patients like the virtual-exposition in the study of Kwanguk et al. (2008). On the other hand, the behavioural-cognitive explanations of checking OCD emphasize responsibility as the principal cause (Arntz, Voncken, & Goosen, 2007; Lopatka & Rachman, 1995; Rachman, 1997), but here the grade of responsibility was similar for all the participants as they were alone in the experimental setting (recorded by video). Nonetheless, the bored participants checked more than those with a progressive advance in their tasks. These results are more in agreement with a behavioural explanation as "experiential avoidance" (Hayes et al., 1996) where a repetitive response has the function of an escape of momentary emotional state, supporting the repetitive checking by negative reinforcement. Furthermore, they confirm the general hypothesis of MacDonald & Davey (2005) suggesting that any negative emotion could produce a repetitive checking. Since boredom is a negative emotion, it could produce checking. According to the general model of psychopathology of Aldao, Nolen-Hoekseman& Schweizer (2010) any context situation or any task producing persistent negative emotions could trigger repetitive or ritualistic responses in order to control the negative emotions. This model is the same as that of Hayes (Hayes et al., 1996; Hayes, Strosahl, & Wilson, 1999; Hayes & Lillis, 2012) regarding "experiential avoidance", where an individual tries to eliminate, escape from or avoid any sensation, emotion or experiential feeling which may not always be that of anxiety. Therefore, we consider this study a good experiment to show how a task (boring or demanding), can produce negative emotions from which an individual tries to escape, resulting in avoidance responses such as repetitive checking.

If this study is to be repeated, it is suggested that a different more representative sample were used in order to generalize the results more effectively, specifically within a non-university population, clinical samples with checking problems, or perhaps using tasks more similar to real-virtual situations. The research has also shown that a repetitive task with minimal difficulty during a long period of time has proven to produce more repetitive checking; perhaps for university students, monotony is more aversive. Also, it suggests that it would be beneficial to define and record the task aversion perceived by the participants as an additional variable, but the rate attempts/time is a cue of that aversive nature. This would allow more empirical evidence to be obtained on the function of avoidance and the aversive situation characteristics that could lead to obsessive-compulsive responses such as the checking responses studied here. Finally, this study was carried out with a non-clinical population and could be considered as producing the same avoidance response as would occur in individuals with obsessive-compulsive checking problems. When these individuals have to confront real emotional situations (of extreme boredom or anxiety), "experiential avoidance" occurs leading to repetitive behaviour.

References

Abramowitz, J.S., & Moore, E.L. (2007). An experimental analysis of hypochondriasis. *Behaviour Research and Therapy*, *45*(3), 413-424.

Aldao, A., Nolen-Hoekseman, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*, 217-237.

American Psychiatric Association (2001). *Diagnostic and statistical manual of mental disorders* (4ª ed. Revisited text). Wasington, DC: Author.

Arntz, A., Voncken, M., & Goosen, C.A. (2007). Responsibility and obsessive-compulsive disorder: An experimental test. *Behaviour Research and Therapy*, *45*(3), 425-435.

Barlow, D.H. (2002). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. New York: Guildford Press.

Borkovec, T.D., Alcaine, O., & Behar, E. (2004). Avoidance theory of worry and generalized anxiety disorder. In R.G. Heimberg, C.L. Turk, & D.S. Mennin (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 77-108). New York: Guilford.

Bouchard, C., Rheaume, J., & Ladouceur, R. (1999). Responsibility and perfectionism in OCD: An experimental study. *Behaviour Research and Therapy, 37,* 239-248.

Brown, L., Sherbenou, R.J., & Johnsen, S.K. (1997). TONI-2 Test de inteligencia no verbal [Test of Nonverbal Inteligence]. Madrid: TEA.

Coles, M.E., Heimberg, R.G., Frost, R.O., & Steketee, G. (2005). Not just right experiences and obsessive-compulsive features: Experimental and self-monitoring perspectives. *Behaviour Research and Therapy*, *43*(2), 153-167.

Cromer, K.R., Schmidt, N.B., & Murphy, D.L. (2007a). An investigation of traumatic life events and obsessive-compulsive disorder. *Behaviour Research and Therapy*, *45*(7), 1683-1691.

Cromer, K.R., Schmidt, N.B., & Murphy, D.L. (2007b). Do traumatic events influence the clinical expression of compulsive hoarding?. *Behaviour Research and Therapy*, *45*(11), 2581-2592.

Eisen, J.L., Mancebo, M.A., Pinto, A., Coles, M.E., Pagano, M.E., Stout, R., & Rasmussen, S.A. (2006). Impact of obsessive-compulsive disorder on quality of life. *Comprehensive Psychiatry, 47*, 270-275.

Fairbrother, N., Newth, S.J., & Rachman, S. (2005). Mental pollution: Feelings of dirtiness without physical contact. *Behaviour Research and Therapy*, *43*(1), 121-130.

Gwilliam, P., Wells, A., & Cartwrith-Hatton, S. (2005). Does meta-cognition or responsibility predict obsessive-compulsive symptoms: A test of the metacognitive model. *Clinical Psychology and Psychotherapy, 11*(2), 137-144.

Hayes, S.C., Strosahl, K.D., & Wilson, K.G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York: Guilford Press.

Hayes, S.C., Wilson, K.G., Gifford, E.V., Follette, V.M., & Strosahl, K.D. (1996). Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology, 64*, 1152-1168.

Hayes, S.C., & Lillis, J. (2012). *Acceptance and Commitment Therapy: Theories of Psychotherapy*. NY: APA.

Hodgson, R.J., & Rachman, S. (1977). Obsessional-compulsive complaints. *Behaviour Research and Therapy*, *15*, 389-395.

Houts, A.C. (2005). Behavioral and functional animal models of OCD. In Abramowitz, J.S., & Houts, A.C. (Eds.), *Concepts and controversies in obsessive-compulsive disorder* (pp. 73-94). New York: Springer US.

Insel, T.R., Mos, J., & Olivier, B. (1994). Animal model of obsessive-compulsive disorder: A review. In Hollander, E., Zohar, J., Marazzitti, D., & Olivier, B. (Eds.), *Current insights in obsessive-compulsive disorder* (pp. 117-135). Chichester: John Wiley & Sons.

Khanna, S., Rajendra, P.N., & Channabsavanna, S.M. (1988). Life events and onset of obsessive-compulsive disorder. *International Journal of Social Psychiatry, 34*, 305-309.

Kwanguk, K., Chan-Hyung, K., Kyung, C., Junyoung, P., Kiwan H., Yun, K., Jae-Jin, K., Young, K., & Sun, I. (2008). Anxiety provocation and measurement using virtual reality in patients with obsessive-compulsive disorder. *Cyberpsychology & Behavior, 11,* 637-641.

Ladouceur, R., Rheaume, J., Freeston, M.H., Aublet, F., Jean, K., & Lachance, C. (1995). Experimental manipulation of responsibility: An analog test for models of obsessive-compulsive disorder. *Behavior Research and Therapy*, *33*, 937-946.

Leckman, J.F., Walker, D.E., Goodman, W.K., Pauls, D.L., & Cohen, D.J. (1994). ''Just right'' perceptions associated with compulsive behavior in Tourette's syndrome. *American Journal of Psychiatry, 151,* 675-680.

Lopatka, C., & Rachman, S.J. (1995). Perceived responsibility and compulsive checking: An experimental analysis. *Behaviour Research and Therapy, 33*, 673-684.

MacDonald, B.C., & Davey, G.C.L. (2005). A mood-as-input account of perseverative checking: The relationship between stop rules, mood and confidence in having checked successfully. *Behaviour Research and Therapy, 43,* 69-91.

McKeon, J.P., Roa, B., & Mann, A. (1984). Life events and personality traits in obsessive-compulsive neurosis. *British Journal of Psychiatry, 144*, 185-189.

Mellitz, M., Hineline, P.N., Whitehouse, W.G., & Laurece, M.T. (1983). Duration-reduction of avoidance sessions as negative reinforcement. *Journal of Experimental Analysis of Behavior*, *40*(1), 57-67.

Mind Scape (2007). *Brain Trainer. Software de entrenamiento mental (computer software)*. Barcelona: Planeta de Agostini.

Monitorius-Spy-Software (2002). *Golden Eye v. 4.11 (computer software)*. Virginia. USA.

Mowrer, O.H. (1960). *Learning theory and behavior.* New York: John Wiley and Sons.

Myers, S.G., Fisher, P.L., & Wells, A. (2009). An empiric test of the metacognitive model of obsessive-compulsive symptoms: Fusion beliefs, beliefs about rituals and stop signals. *Journal of Anxiety Disorders, 23*(4), 436-442.

Nestersoft (2003). *Timeleft v. 3.44*. (computer software). Ontario. Canada.

Olatunji, B.O. (2010). Changes in disgust correspond with changes in symptoms of contamination-based OCD: A prospective examination of specificity. *Journal of Anxiety Disorders*, *24*(3), 313-317.

Parkinson, L., & Rachman, S. (1981). Intrusive thoughts: The effects of an uncontrived stress. *Advances in Behavior Research and Therapy, 3,* 101-110.

Price, K.P., & Geer, J.H. (1972). Predictable and unpredictable aversive events: Evidence for the safety-signal hypothesis. *Psychonomic Science*, *26*, 215-216.

Rachman, S., & Hodgson, R. (1980). *Obsessions and compulsions*. Englewood, NJ: Prentice-Hall.

Rachman, S. (1997). A cognitive theory of obssesions. *Behavior Research and Therapy, 35,* 793-802.

Rachman, S. (1998). A cognitive theory of obssesions. Elaborations. *Behavior Research and Therapy, 36,* 384-401.

Rachman, S. (2002). A cognitive theory of compulsive checking. *Behavior Research and Therapy, 40,* 625-639.

Rasmussen, S.A., & Eisen, J.L. (1990). Epidemiological and clinical features of obsessive-compulsive disorder. In Jenike, M.A., Baer, L., & Minilchiello, W.E. (Eds.), *Obsessive-compulsive disorders: Theory and management* (pp. 10-27). Chicago: Year Book.

Salkovskis, P.M. (1985). Obsessional-compulsive problems: A cognitive-behavioral analysis. *Behavior Research and Therapy, 23,* 571-583.

Salkovskis, P.M., & Kirk, J. (1997). Obsessive-compulsive disorder. In D.M. Clark & C. Fairburn (Eds.), *The science and practice of cognitive behavior therapy*. Oxford: Oxford University Press.

Shafran, R. (2005). Cognitive-behavioral models of OCD. In Abramowitz J.S. & Houts, A.C. (Eds.), *Concepts and controversies in obsessive-compulsive disorder* (pp. 229-260). New York: Springer US.

Spielberger, C.D., Gorsuch, R.L., & Lushene, R.E. (1994). *Cuestionario de Ansiedad Estado-Rasgo* (4ª ed.) [State-Trait Anxiety Inventory], Madrid: Publicaciones de Psicología Aplicada.

Stein D.J., Dodman, N.H., Borchelt, P., & Hollander, E. (1994). Behavioral disorders in veterinary practice: Relevance to psychiatry. *Comprehensive Psychiatry, 35*, 275-285.

Steketee, G., Frost, R., & Bogart, K. (1996). The Yale-Brown Obsessive Compulsive Scale: Interview versus self-report. *Behavior Research and Therapy, 34*, 671-684.

Steketee, G.S., & Frost, R.O. (1998). Obsessive-compulsive disorder. In A.S. Bellack & M. Hersen (Eds.), *Comprehensive Clinical Psychology*, vol. 6 (pp. 367-398). Amsterdam: Pergamon.

Sturmey, P. (1996). *Functional analysis in clinical psychology.* New York: Wiley.

Szechtman, H., & Woody, E. (2004). Obsessive-compulsive disorder as a disturbance of security motivation. *Psychological Review, 111,* 111-127.

Van Houten, R., & Axelrod, S. (Eds.) (1993). *Behavior analysis and treatment*. New York: Plenum.

Weissman, M.M., Bland, R.C., Camino, G.J., & Greenwald, S. (1994) The cross national epidemiology of obsessive compulsive disorder. The cross national collaborative group. *Journal of Clinical Psychiatry, 55,* 5-10.

Wells, A. (1997). *Cognitive therapy of anxiety disorders: A practice manual and conceptual guide*. Chichester, UK: Wiley.

Winslow, J.T., & Insel, T.R. (1991). Neuroethological models of obsessive-compulsive disorder. In Zohar, J., Insel, T., & Rasmussen, S. (Eds.), *The psychobiology of obsessive-compulsive disorder* (pp. 208-226). Nueva York: Springer.

Zvolensky, M.J., Lejuez, C.W., & Eifert, G.H. (2000). Prediction and control: Operational definitions for the experimental analysis of anxiety, *Behaviour Research and Therapy*, *38*, 653-663.