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REALITY MONITORING IN A HYPOTHETICALLY HALLUCINATION-PRONE POPULATION

José M. Ruiz-Vargas, Isabel Cuevas and José M. López-Frutos
Universidad Autónoma de Madrid

Reality monitoring in a hypothetically hallucination-prone population. The aim of this work was to analyze the performance of hypothetically hallucination-prone subjects in source discrimination tasks. Two experiments were carried out with external source (pictorial and verbal) discrimination tasks. In Experiment 1, materials and encoding tasks (naming, function, and mental imagery) were manipulated. In Experiment 2, the variables were materials, encoding task and delay of memory test. The results showed that hypothetically hallucination-prone subjects encode external information and make use of information about prototypical features of memory traces in a similar way to non-prone subjects. These findings, discussed within Johnson and Raye's reality monitoring model, may serve to define the conditions under which normal and abnormal source discrimination failures occur.

El objetivo del presente trabajo fue investigar el proceso de "control de la realidad" en una muestra de sujetos con propensión (hipotética) a la alucinación. Se realizaron dos experimentos en los que sujetos con y sin propensión a la alucinación debían discriminar el origen (pictórico o verbal) de sus recuerdos entre diversas fuentes externas. En el experimento 1, se manipularon el tipo de material y la tarea de codificación (denominación, función, y formación de imágenes mentales). En el experimento 2, se manipuló además la variable demora. Los resultados globales indican que los sujetos con alta propensión a la alucinación no presentan problemas al codificar información externa así como que emplean de forma análoga a los sujetos con baja propensión la información relativa a los atributos prototípicos de las huellas de memoria a la hora de identificar el origen externo de sus recuerdos. Estos hallazgos podrían ayudar a establecer las condiciones que potencian la emergencia de fallos normales y anormales en la discriminación de la fuente de los recuerdos.

Hallucinations have generally been considered as one of the commonest and most significant symptoms of schizophrenia (Schneider, 1959; American Psychiatric Association, 1995). For some time, researchers have attempted to understand the association between these types of symptoms and other psychiatric disorders such as manic and affective psychosis. However, according to some approaches (Slade, 1976; Bentall, 1990), hallucinations *per se* can constitute a valid object of study. Various models have recently been proposed that try to explain the variables that influence hallucinations and the processes underlying them. Of particular relevance have been those models emphasizing that at the basis of hallucinations is the generation of abnormally vivid mental images (Sietz and Malholm, 1947; Horowitz, 1975). In this line, different theoretical proposals have emerged with the aim of characterizing this "abnormality". Nevertheless, while for some researchers claim that mental images formed by hallucinating subjects are not as vivid as those generated by non-hallucinators (Cohen, 1938; Starker and Jolin, 1982), others claim that the vividness of these images is far greater in hallucinators (Mintz and Alpert, 1972; Horowitz, 1975; Slade, 1976; López Rodrigo, Paíno, Martínez, Inda and Lemos, 1996). Studies now regarded as classic, such as that of Mintz and Alpert (1972), found that auditory mental images generated by hallucinating schizophrenics were more vivid than those of a control group. On the other hand, Slade (1976) found that two groups of psychotic patients (with and without hallucinations) generated more vivid mental images –in varions sensory modalities– than the control group, despite the fact that neither group were hallucinators. These results suggest that while the vividness of mental images may be a necessary factor for hallucination to take place, it is not a sufficient one. In this sense, some researchers have postulated that hallucination occurs as a consequence of attributing –erroneously– an external origin to an abnormally vivid mental image (Mintz and Alpert, 1972; Slade, 1976; Bentall and Slade, 1985a, 1985b). According to this view, hallucinations could be a conse-

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Correspondence concerning this article should be addressed to Jose M. Ruiz Vargas. *Departam. de Psicologia Básica. Facultad de Psicología. Universidad Autónoma de Madrid. 28049 Madrid. Spain. E-mail: JMR.VARGAS@UAM.ES*

quence of a fanety process of reality monitoring (e.g., Horowitz, 1978; Johnson, 1988; Bentall, 1990; Johnson, Hashtroudi and Lindsay, 1993).

Johnson and Raye (1981) created a frame of reference (*the reality monitoring model*) conceptualize of how normal people identify –correctly or incorrectly– the source of their memories. That is, how they are able to differentiate whether their memories are the product of perceived events (i.e.,have an external origin) or imagined ones (i.e.,have an internal origin); how they decide whether their memories are the result of persondlly-witnessed events or, on the contrary, whether the information recalled originates from a conversation, etc. According to this model, information about the origin of memories is not automatically encoded in memory (Durso and Johnson, 1980; Johnson and Raye, 1981; Johnson, 1985; Foley, Durso, Wilder and Friedman, 1991; Johnson et al., 1993). Thus, there is no label on our memories indicating their origin, but rather this identification is the result of a process of assessment we make of our memory traces once they have been activated. Which mechanisms are responsible for making this assessment? On which factors is the assessment based? According to the reality monitoring model, decisions on the origin of a memory trace may be based on: a) the qualitative characteristics of the trace; b) the characteristics of other related traces (which would play the role of back-up memories), and c) metamnesic assumptions.

With regard to the characteristics of the trace, this approach argues that memory traces –according to their internal or external origin depending on. Thus, memories of external origin have more sensory or perceptual attributes (e.g., colours, smells, sounds), contextual attributes (e.g., place, time) and significant details (e.g., how we felt), whilst memories of internal origin exhibit more information about the cognitive operations related to the encoding phase (e.g., generation of mental images). Therefore, one way of establishing the origin of memory traces is to perform a rapid, non-deliberate exercise of reason, basing one's decision on the prototypicality of the memory's attributes. However, this mechanism is sometimes insufficient, in which case subjects carry out a process of strategic reasoning. In this case, reality monitoring decisions are based on additional information that the subject tries to find in his/her memory (e.g., back-up memories) and/or on metamnesic assumptions about how the memory itself works.

Taking into account these three mechanisms, numerous experimental studies have been carried out with the aim of discovering the main factors that can create confusions, inducing subjects to make erroneous decisions about the origin of their memories. By and large, three factors can be identified, namely: a) non-prototypicality of the attributes of memories (for example, very vivid dreams, which despite being memories of internal origin present a great wealth of sensory and perceptual attributes and scarce information on cognitive operations); b) failure in the search for additional information; and c) errors in our metamnesic assumptions. Within this perspective, an aspect that appears to be a source of confusion between two traces of external origin (pictures vs. words) is the degree of automaticity in the generation of mental images when the subject codifies the material. Durso and Johnson (1980) studied –in normal adult subjects– the effect of the encoding task (verbal, imagery and referential) on discrimination between memory traces generated by pictures and those generated by words. The general hypothesis of this study was that subjects, after carrying out the referential task (in which they implicitly generated mental images), would make more errors in identifying the origin of their memories. Specifically, they would attribute a different external origin to their memory traces derived from words, confusing them with traces derived from pictures. As predicted, words were discriminated more poorly than pictures only after the referential task. In a more recent work, Foley, Durso, Wilder and Friedman (1991) obtained identical results when comparing performance in reality monitoring tasks of children (aged 6 to 9) with that of adults.

On the basis of these assumptions, it does not seem unreasonable to suggest that, if a cognitive explanation for hallucinations can be gleaned from the fact that people experiencing them make erroneous use of their reality monitoring processes, we might expect normal people with a high propensity to hallucinate to exhibit a significantly greater pattern of confusions than people with low propensity to hallucinate in tasks that require them to establish precisely the source of memories. In line with this argument, the general objective of the present research was to analyze reality monitoring processes in subjects with high and low propensity to hallucinate. More specifically, our aim was to investigate the mechanisms involved in discriminating the source of memories of external origin. Our hypothesis was that the same processes that explain both correct and erroneous functioning in normal subjects when establishing the source of their memories would be employed by subjects with a high propensity for hallucination in tasks of a similar nature, even if the latter would make more errors than subjects with a low propensity to hallucinate. Given the absence of studies on discrimination between external sources of memories in subjects with a high propensity to hallucinate, the research path opened up by this work is of particular interest, as it allows us to establish an explanatory continuum between mormality and pathology.

EXPERIMENT 1

Method

Subjects. 24 students of Psychology from the Universidad Autónoma in Madrid (Spain) participated in the study. The age range was 18 to 24 years. The students were selected on the basis of their scores in the Launay-Slade (1981) hallucination questionnaire. According to Bentall and Slade (1985b), some pathological symptoms –such as the propensity to hallucinate– are normally distributed in the population. Under this hypothesis the Launay-Slade questionnaire was administered to 501 students. Of these, the subjects selected were those situated two standard deviations from the mean –both above and below– (mean = 4.2 and standard deviation = 2.59). Thus, our study was carried out with two groups of 12 students each: one group with low score in propensity to hallucinate (henceforward referred to as "normal") and another with high score, or hypothetically hallucination-prone.

Materials. Firstly, 48 stimulus cards were prepared (15 x 10 cms.): 24 bore a word and the other 24 a picture. All stimuli were selected from the University of Valencia Computerized Word Pool (Algarabel, Ruiz and Sanmartin, 1988), with the following criteria: high imagery (range 5.42-6.53), high concreteness (range 6.1-6.87), neutral significance (range 3.11-5.5), high prototypicality (range 5.29-6.63), controlled number of meanings (range 1-17), low frequency of use (range 6-85), and limited familiarity (range 3.5-6). Based on half of the selected words the pictorial stimuli were prepared (simple drawings). Subsequently, 12 random series were constructed to establish the order of presentation of the stimuli. The sequence of pictures and words was randomized with one restriction: it always began with two pictures and two words, or vice-versa.

Secondly, another 48 cards were prepared, containing the questions related to each one of the presented stimuli. 16 cards told the subject to say aloud what the stimulus was, another 16 asked him/her to indicate its function, and finally, the remaining 16 requested the subject to generate a mental image of the stimulus and assess its vividness on a 1 to 10 scale. Half of the questions (eight of each type) were randomly assigned to the pictures and the other half to the words. Lastly, 48 more words –with characteristics similar to those of the critical stimuli– were selected to be used as distractors in the test phase.

Procedure. Each subject carried out the task individually in conditions of incidental learning. The instructions given in the training phase were as follows: "We are now going to carry out an experiment in which you have to perform three types of task with a series of pictures and words that we shall present to you on this screen (tachistoscope). The task you have to carry out in each case will be indicated to you through this set of cards. Sometimes, the card will tell you to say aloud what the stimulus is that appears on the screen. Other times, it will tell you to write down as quickly as possible the function or use of the stimulus presented. Finally, another type of task you may be given is to form a mental image of the stimulus indicated, and to say on a scale of 1 to 10 how vivid that image is." Before beginning the study phase, all subjects carried out four practice trials in order to become familiar with and to understand the task.

Thus, in the study phase subjects read the card given by the experimenter, looked at the screen (tachistoscope), on which the stimulus was presented for 250 milliseconds, and, in accordance with the task involved, made their response. Presentation rate of the critical stimuli was 1 every 8 seconds.

Once this phase was over, all subjects spent 5 minutes doing a distractor task: making geometrical figures with the WAIS cubes. Finally, subjects carried out a task to discriminate the origin of their memories between two external sources: pictures and words. Their instructions were as follows: "We shall read aloud a list of words. Some have already been presented to you on the screen, either as a picture or as a word, while others have not been presented previously. Your task is to tell us, for each one of the words, whether you remember having seen it as a picture, as a word, or whether it is new for you." Responses given were registered by the experimenter.

Design. In this experiment three variables were manipulated: propensity to hallucinate (high, low), type of material (pictures and words) and encoding task (naming, function and explicit generation of mental images, or *imagery*). The last two variables were manipulated at a within-subjects level. The dependent variable was "reality monitoring for external-source memories", assessed by means of: a) a source discrimination task (with regard to the origin of the memories), and b) a recognition measure. In order to eliminate possible perceptual priming effects (see Tulving and Schacter, 1990; Ruiz-Vargas and Cuevas, 1996), both tests were carried out in auditory mode. Thus, the design was a between/within-subjects factorial 2x2x3.

RESULTS AND DISCUSSION

Reality monitoring: Discriminating pictures and words. Table 1 shows the mean proportions of discrimination of memory trace origin and the standard deviations. As in other studies (Johnson and Raye, 1981; Foley et al., 1991), the scores in discrimination of pictures were obtained by dividing "number of pictures correctly identified" by "number of pictures identified as pictures plus those identified as words". Similarly, scores in discrimination of words were established by dividing "number of words correctly identified" by "number of words identified as words plus those identified as pictures".

A fixed effects 2x2x3 ANOVA, with repeated measures in the last two factors and angular transformation, was carried out. The results showed a significant effect of the following variables and interactions: type of material $F(1,22) = 19.31$, $MSe = 0.04$ ($p < 0.00l$); encoding task $F(2,44) = 5.08$, $Mse = 0.03$ ($p < 0.05$); and interaction between type of material and encoding task $F(2,44) = 7.88$, $MSe = 0.02$ ($p < 0.005$). Finally, we also found a trend towards significance (alpha = 0.064) of the interaction between propensity to hallucinate and type of material. No other variables or interactions were found to be significant.

Subsequently, *post hoc* multiple-comparison Tukey tests were carried out for the significant variables and interactions. This analysis showed that: a) pictures were discriminated better than words (0.98 vs. 0.90); b) the proportion of discrimination in the naming task was superior (0.96) to that obtained in the "function" condition (0.90); and c) subjects discriminated more poorly the origin of their memories after the function task by comparison with the other two experimental conditions. In fact, only in the function condition did the subjects make more errors on confusing the memories derived from words with those from pictures.

An interesting result concerned the tendency of subjects with high propensity for hallucination to discriminate equally, and with a high degree of precision, the origin of memories derived from pictures and from words (0.97 vs. 0.92). In contrast, the normal subjects discriminated better the memories derived from pictures (0.98 vs. 0.87). Thus, the results appear to indicate that only the normal subjects tended to make errors in the discrimination of the origin of memories coming from two external sources, in the sense of confusing words with pictures. Nevertheless, it should be borne in mind that this result did not reach significance level, and for this reason we consider it necessary to re-examine this effect.

Recognition of pictures and words. On the basis of the discrimination data a secondary analysis was made (Glass, 1976), with the aim of assessing to what extent the poorer performance in discrimination of words compared to pictures could be attributed, simply, to poor recognition. To this end, the number of items recognised was divided by the number of targets presented in each experimental condition. Table 2 shows the mean proportions of recognition of pictures per experimental condition, together with their standard deviations.

A 2x2x3 ANOVA, with repeated measures in the last two factors and angular transformation, was carried out. It indicated a significant effect of the variable type of material $F(1,22) = 6.19$, $Mse = 0.05$ ($p < 0.05$) and an interactive effect between the variables type of material and encoding task $F(2,44) = 10.81$, $Mse = 0.05$ ($p < 0.001$). *Post hoc* multiple-comparison Tukey tests revealed that: a) pictures were recognized better than words (0.80 vs. 0.72); b) words in the function condition were recognised better than in the naming condition (0.76 vs. 0.59); c) words were recognized equally well in the function and explicit generation of

Table 1
Mean proportions and standard deviations in discrimination of memory source, for each experimental condition

Encoding task		Naming		Function		Imagery	
Propensity to hallucinate		Pictures	Words	Pictures	Words	Pictures	Words
High	Mean	0.98	0.96	0.98	0.85	0.96	0.97
	S.D.	0.05	0.10	0.05	0.19	0.07	0.07
Low	Mean	1.0	0.94	0.98	0.80	0.95	0.88
	S.D.	0.0	0.12	0.05	0.18	0.11	0.11

Table 2
Mean proportions of recognition of pictures and words, and standard deviations, for each experimental condition

Type of task		Naming		Function		Imagery	
Propensity to hallucinate		Pictures	Words	Pictures	Words	Pictures	Words
High	Mean	0.86	0.62	0.81	0.78	0.73	0.83
	S.D.	0.21	0.27	0.14	0.18	0.26	0.27
Low	Mean	0.83	0.57	0.81	0.75	0.76	0.76
	S.D.	0.09	0.19	0.09	0.17	0.17	0.22

mental images conditions; d) recognition for pictures and words was not different in either the function condition (0.81 vs. 0.76) or the imagery condition (0.74 vs. 0.79); e) recognition of pictures was identical in the three experimental conditions; f) in the naming condition, pictures were recognized better than words; and g) pictures in the function condition were recognized better than words in the naming condition. Of all of these findings, two are especially relevant. On the one hand, it was observed that in the function condition there were no significant differences in the recognition of pictures (0.86) and words (0.76), while it was precisely in this condition where differences appeared in the discrimination of the memory source, with errors being made in terms of confusing words with pictures. On the other hand, the differences found in recognition of pictures and words in the naming condition (0.85 vs. 0.59) do not correspond to a differential performance in the discrimination of the origin of memories (0.98 vs. 0.95). Thus, errors in discrimination cannot be attributed to poor recognition.

Finally, it should be stressed that no differences were found between the recognition memory of the normal subjects and that of those with a tendency to hallucinate.

In order to replicate and extend these results, a second experiment was carried out.

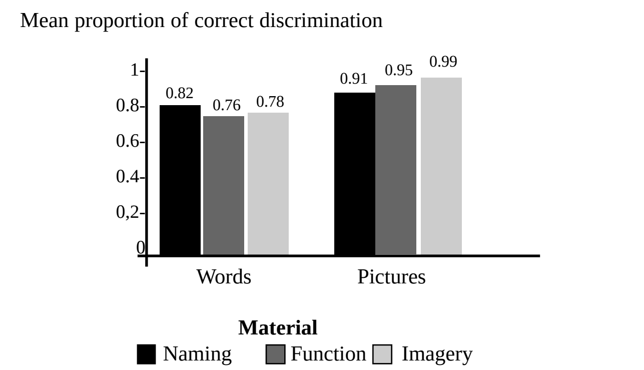
EXPERIMENT 2

Method

Subjects. From a sample of 500 first-year Psychology students at the Universidad Autónoma in Madrid (Spain), 20 subjects were selected, according to the criteria of Experiment 1.

Materials and Procedure. Both the materials used and the procedure followed were the same as in Experiment 1. The only modification was the inclusion of the variable delay (0, 1 and 10 days) at a within-subjects level.

Figure 1
Discrimination between external sources of memories after different encoding tasks



Design. In this experiment four variables were manipulated: propensity to hallucinate (high, low), type of material (pictures and words), encoding task (naming, function and explicit generation of mental images, or *imagery*), and delay (0, 1 and 10 days). The last three variables were manipulated at a within-subjects level. The dependent variable was reality monitoring for external sources, measured through a test of discrimination of the origin of memories and a recognition measure. The design was a between/within-subjects factorial 2x2x3x3.

RESULTS AND DISCUSSION

Performance in reality monitoring: Discriminating pictures and words. A 2x2x3x3 ANOVA, with repeated measures in the last three factors and angular transformation, was carried out. The results show main effects of the variables type of material $F(1,18) = 4.57$, $MSe = 107.05$ ($p < 0.05$) and delay $F(2,36) = 14.68$, $MSe = 195.85$ ($p < 0.0l$). Also significant were the following interactions: encoding task x type of material $F(2,36) = 8.05$, $MSe = 311.90$ ($p < 0.01$) and delay x type of material $F(2,36) = 6.41$, $MSe = 83.32$ ($p < 0.0l$). No other variables nor interactions were found to be significant.

Subsequently, *post hoc* multiple-comparison Tukey tests were carried out for each of the significant variables and interactions. These results showed that: a) pictures were discriminated better than words (0.95 vs. 0.82); b) performance in discrimination deteriorated after 24 hours, remaining constant after 10 days (0.88 vs. 0.89); c) as in Experiment 1, the interaction between the variables type of material and encoding task reflected that the increase in source discrimination errors for memories derived from words only occurred in the function condition Figure 1 and Table 3); and d) the interaction between delay and type of material reflected that the passage of time differentially affected the discrimination of the origin of memories derived from pictures and from words. Thus, whilst selective errors on confusing the origin of the memory of pictures with words increased after 24 hours, 10 days had to elapse before there was an increase in the initial errors in the discrimination of traces derived from words (see Table 4).

On the other hand, the results of this experiment did not replicate the tendency –found in Experiment 1– of hallucination-prone subjects to better differentiate the external origin of their memories. In fact, the two groups of subjects obtained the same pattern of results in the discrimination test. Thus, both discriminated pictures better than words, both made more errors in terms of confusing words with pictures (only in the function condition) and, finally, the passage of time affected similarly their precision/imprecision in discrimination.

Recognition of pictures and words. Once more, in order to discard the possibility that discrimination errors are due to recognition failures, a secondary analysis was carried out (Glass, 1976).

Thus, on the basis of the proportions of recognition a 2x2x3x3 ANOVA, with repeated measures in the last three factors and angular transformation, was carried out. The results of the ANOVA showed main effects of the following variables: encoding task $F(2,36) = 6.31$, $MSe = 467.99$ ($p < 0.01$); type of material $F(1,18) = 15.60$, $MSe = 353.62$ ($p < 0.01$); and delay $F(2,36) = 3.95$, $MSe = 201.77$ ($p < 0.05$). Also, as in Experiment 1, the interaction between type of material and encoding task was found to be significant $F(2,36) = 28.4$, $MSe = 268.56$ ($p < 0.01$).

Table 3
Mean proportions and standard deviations in discrimination of external origin of memories according to encoding task

Type of task	Naming		Function		Function Imagery	
Type of material	Pictures	Words	Pictures	Words	Pictures	Words
Mean	0.82	0.91	0.76	0.95	0.86	0.99
S.D.	0.25	0.37	0.25	0.27	0.16	0.12

Table 4
Mean proportions and standard deviations in discrimination of external origin of memories according to delay

Delay	No delay		1 day		10 days	
Type of material	Pictures	Words	Pictures	Words	Pictures	Words
Mean	0.972	0.84	0.91	0.84	0.99	0.78
S.D.	0.14	0.53	0.13	0.28	0.12	0.21

Table 5
Mean proportions of recognition and standard deviations for pictures and words, according to delay and encoding task

Delay	Type of material	Encoding task	Naming	Function	Imagery
No delay	Words	Mean	0.58	0.90	0.92
		S.D.	0.30	0.18	0.14
	Pictures	Mean	0.91	0.91	0.83
		S.D.	0.11	0.11	0.18
1 day	Words	Mean	0.63	0.84	0.83
		S.D.	0.25	0.17	0.16
	Pictures	Mean	0.92	0.90	0.83
		S.D.	0.13	0.12	0.20
10 days	Words	Mean	0.66	0.81	0.80
		S.D.	0.20	0.17	0.17
	Pictures	Mean	0.87	0.86	0.83
		S.D.	0.16	0.13	0.15

Post hoc multiple-comparison Tukey tests indicated that: a) recognition for the function condition was superior to that for the other conditions –among which there were no differences; b) pictures were recognized better than words; c) mnesic performance decayed after a delay of 10 days; d) in the naming condition, pictures were recognized better than words; e) in the function condition, recognition of pictures and words were equivalent; and f) in the mental imagery condition, words were recognized better than pictures.

These results replicate and extend those obtained in Experiment 1. Thus, there is sufficient evidence to assert that the failures in the reality monitoring process that occurred in the task of discrimination between the two external sources of memories were not due to failures in recognition memory. Note that the interactions between type of material and encoding task went in opposite directions in discrimination and recognition.

GENERAL DISCUSSION

The present work studied the decision process involved in tasks of discrimination between two external sources of memories. In particular, a comparison was made between the effects of spontaneous generation (function condition) and of explicit generation of mental images (mental imagery condition) on decisions made by normal subjects and hypothetically hallucination-prone subjects in judgements on the external origin of their memories. Among all the findings obtained, two deserve special attention for their theoretical implications. On the one hand, subjects with a propensity to hallucinate showed a similar pattern to that of normal subjects, both in tasks of discrimination between external sources of memories and in recognition memory tasks. On the other hand, the results obtained with hallucination-prone subjects replicate and rxtendthose obtained in previous research with normal adults (Durso and Johnson, 1980) and children (Foley et al., 1991).

It should be pointed out that hallucination-prone subjects –like normal subjects– are more likely to confuse the origin of their memories in the condition in which they spontaneously generate mental images (i.e., function condition). This result suggests that hallucination-prone subjects use the cues associated with cognitive operations in their decisions on the origin of memories. Thus, when the mental images were generated implicitly or spontaneously and, consequently, the operations involved in the generation were less deliberate and similar to those involved in the perceptual processing of pictorial stimuli (drawings), they became sources of error. That is, in these conditions, information on cognitive operations did not turn out to be an effective cue in the reality monitoring process. On the other hand, when subjects explicitly generated mental images their cognitive operations were more salient, this information being an effective aid for discriminating the origin of their memories. Thus, the memories derived from the task of explicitly generating mental images contained accessible information on the cognitive operations the subject had carried out –information that was additional to the sensory or perceptual information–, which helped him/her to discriminate whether the memory came from a picture or from a word. This is why both normal subjects and hallucination-prone ones made more errors confusing words with pictures only in the function condition. These findings show that normal and hallucination-prone subjects use similar heuristics in the decision process concerning the external origin of memories, with no qualitative differences being found between them, even when the delay of the decision was 10 days (Experiment 2). Nevertheless, these results contrast those of other researchers, who argue that hallucinating subjects fail to use cognitive operations (specifically, cognitive effort) as a cue in decisions on the origin of their memories (Bentall, Baker and Havers, 1991). Bentall and cols. (1991) compared the reality monitoring process of normal and hallucinating subjects in a task of discrimination between memories of internal and external origin. Firstly, subjects were requested to generate words associated with a key word (varying the level of difficulty of the association) and to listen to a list of pairs of words (some with high and others with low probability of association). One week later, subjects had to identify the origin of a set of items shown to them by the experimenter –that is, they had to say whether the items had been generated by them, presented by the experimenter or, on the contrary, had not appeared at all. The results showed the hallucinators to be less precise than the normal subjects in the identification of the origin of their memories. However, these differences were found only when the generation of the items had demanded high cognitive effort. On the basis of this result it was inferred that hallucinators may fail to use cognitive effort as a cue in reality monitoring tasks. In contrast, our results appear to indicate that hallucination-prone subjects are indeed capable –like normal subjects– of using in an effective way information on certain cognitive operations to identify the external origin of their memories.

It should also be pointed out that the results obtained in identification of the origin of memories derived from words cannot be explained in terms of poor recognition memory. In fact, the results of discrimination and recognition reflected a pattern of dissociation. Thus, a recognition performance equivalent for pictures and words corresponded to different levels of identification, and vice-versa.

Finally, it should be emphasized that both normal subjects and those prone to hallucination presented the picture superiority effect only in the naming condition (Nelson, Reed and Walling, 1976; Durso and Johnson, 1980; Intraub and Nicklos, 1985; Marks, 1989; Foley et al., 1991; Bajo and Cañas, 1988a, 1988b; Cuevas, 1995). This result would appear to indicate that hallucination-prone subjects do not show any problems in the encoding of verbal and pictorial material, at least with simple stimuli (e.g., words and simple pictures).

In sum, the results obtained suggest that subjects with a propensity for hallucination have no problems in encoding external information, and use in a similar way to normal subjects the information relative to the prototypical attributes of memory traces for identifying the external origin of their memories. Nevertheless, we are aware of the need to extend this work and to investigate the reality monitoring process –with hallucination-prone and normal subjects–, comparing their performance in tasks of discrimination between internal and external sources of memories and, on the other hand, by analyzing their discrimination in restrictive conditions that demand a more strategic decision process based not only on the qualitative features of memory (Bentall, 1990). Only thus shall we be able to delimit in a comprehensive way exactly when failures –normal and pathological– occur in the reality monitoring process, with a view to assessing their role in the genesis of hallucinations.

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