

Method for evaluating subjective states of awareness that accompany recognition: adaptation for use in Portuguese-speaking patients with schizophrenia

Adaptação para o português de método de avaliação dos estados subjetivos de consciência que acompanham o reconhecimento para uso em pacientes com esquizofrenia

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Original version accepted in Portuguese

Abstract

Objective: Memory is composed of several systems and processes, and recognition can be accompanied by two subjective states of consciousness: auto-noetic awareness, which characterizes conscious recollection; and noetic (or semantic) awareness, related to feelings of familiarity. The objective of this study was to describe the adaptation to Portuguese of an experiential procedure for investigation of states of awareness that accompany recognition. **Methods:** Development of the material (word list and instructions permitting manipulation of the level of information processing); translation/adaptation of the original instructions to Portuguese; and application of the procedure in healthy volunteers and patients with schizophrenia. Manipulation of the level of processing consisted in requiring, during the learning phase, that subjects form a phrase or count the number of letters of the words presented. The level of processing, documented in healthy volunteers, should be expressed by greater conscious recollection of words used to form phrases than of words for which letters were counted. In addition, there should be no change in the proportion of recognition based on feelings of familiarity. **Results:** The procedure was first applied in six healthy volunteers, in whom the processing level effect was clearly reproducible. Subsequently, it was used in patients with schizophrenia, who understood and followed the instructions perfectly. There was also a clear processing level effect in the patient group. **Conclusions:** The Portuguese version of this method can be used in our milieu, even in patients with schizophrenia, allowing the study of memory alterations accompanying this mental disorder.

Keywords: Memory; Recognition (psychology); Conscience; Schizophrenia; Evaluation studies

Resumo

Objetivo: A memória é composta por vários sistemas e processos e o reconhecimento pode ser acompanhado por dois estados subjetivos de consciência: a consciência auto-noética, que caracteriza a rememoração consciente, e a noética, relacionada a sentimentos de familiaridade. O nosso objetivo foi descrever a adaptação para o português de método experimental para investigação dos estados de consciência que acompanham o reconhecimento. **Métodos:** Desenvolvimento do material (lista de palavras e instruções que permitem manipulação do nível de processamento das informações); tradução/adaptação das instruções originais para o português e aplicação do procedimento em voluntários sãos e portadores de esquizofrenia. A manipulação do nível de processamento consistiu em solicitar, na fase de aprendizagem, que o sujeito formasse uma frase com as palavras apresentadas ou contasse suas letras. O efeito nível de processamento, documentado em voluntários sãos, seria expresso por maior rememoração consciente para as palavras com as quais foram formadas frases do que para aquelas cujas letras foram contadas. Além disso, não deveria haver mudança da proporção de reconhecimentos baseados em sentimento de familiaridade. **Resultados:** O procedimento foi aplicado em seis voluntários sãos, nos quais se reproduziu nitidamente o efeito nível de processamento. Num segundo momento, foi aplicado em seis pacientes com esquizofrenia, que compreenderam perfeitamente as instruções e foram capazes de realizá-lo como solicitado. Neles também foi evidenciado o efeito nível de processamento. **Conclusões:** O método adaptado para o português pode ser utilizado em nosso meio, inclusive em pacientes com esquizofrenia, permitindo o estudo mais aprofundado das alterações de memória associadas a este transtorno mental.

Descritores: Memória; Reconhecimento (psicologia); Consciência; Esquizofrenia; Estudos de avaliação

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Introduction

Memory, the cognitive function that represents/organizes the personal history of an individual, as well as influencing their way of, consciously or unconsciously, perceiving, feeling, thinking and responding, is no longer considered a unitary phenomenon.¹ Based on studies initiated approximately 40 years ago, it is currently held as being susceptible to decomposition into multiple interactive processes and interrelated systems.²

Tulving described three types of consciousness that characterize three different memory systems.³ The first, which he dubbed "anoetic awareness", is related to procedural memory, the automatic memory involved in activities such as driving a car or riding a bicycle. Anoetic awareness is temporally and spatially bound to the current situation. It permits perceptive registration and an internal representation of the close environment, as well as a behavioral response to the different aspects of this environment. The second is "noetic awareness", which is associated with semantic memory. This, also known as memory for general knowledge, includes knowledge of history, geography, languages and natural sciences, or even the perfume of flowers. It allows an individual to be aware of objects, events, and their relationships, making it possible to perform cognitive operations that include such objects, events and relationships, even in their absence.⁴ The third and final type is "autonoetic awareness", which characterizes episodic, also known as autobiographic, memory. It is the memory one has for events such as one's own wedding, the birth of a child or the loss of a loved one. Autonoetic awareness allows the person who remembers a personal event to recognize it as belonging to one's own biography. It is the self-awareness the individual has and encompasses the capacity of apprehending one's past and projecting one's future.⁴

Tulving developed an experimental approach, later elaborated upon by Gardiner and Java,⁵ to study the relations between consciousness and memory.³ The self-evaluation method of the states of consciousness that accompany recognition is based on the presupposition that consciousness is not a unitary phenomenon but consists of two distinct states: conscious recollection (autonoetic awareness) and feelings of familiarity (noetic awareness).^{3,5-6}

The method of self-evaluation of the states of consciousness that accompany recognition requires that the subject evaluate the subjective state of consciousness being experienced at the moment an item is recognized in a test of classic recognition. The state of consciousness is identified by two types of responses: "R" (indicated by the letter "R") and "I know" (indicated by the letter "K"). If recognition is accompanied by conscious recollection (a specific memory of what the subject thought or felt at the sight of the item in the learning phase), the response should be "I remember." This recollection can, for example, correspond to the autobiographic reliving of a memory evoked by the item, an image, or even an event that might have occurred at the time of learning. The "R" response reveals autonoetic consciousness. However, the subject answers "K" when recognition is accompanied only by a feeling of familiarity. In this case, the subject knows the item was shown before but cannot say anything specific about it. This response reveals noetic consciousness. The option "I guess" (indicated by the letter "G") has recently been added to the test since some subjects answered "K" when they were actually only assuming they had seen a certain item during the learning phase.⁷⁻⁸

Studies of recollection potential,⁹⁻¹⁰ including those involving functional neuroimaging,¹¹ have revealed differences in cerebral activation depending on the subjective state of consciousness

(conscious recollection or feelings of familiarity). In addition, several experimental variables have been shown to independently influence these two states of consciousness, strongly indicating that the two are truly distinct, and suggesting that they are related to different cognitive processes.^{5,12-25}

One such variable is the level of information processing. Processing here refers to the cognitive processes that participate in the transformation of a stimulus into a mnemonic representation. In cognitive psychology, the terms "treatment" and "codification" are also used. Processing can be superficial and deal only with the perceptive characteristics of the stimulus (sensorial treatment), or it may be deeper and more elaborate (semantic treatment).²⁶ The semantic treatment enriches mnemonic features, making them more concrete and easier to distinguish than those observed when the information is treated in a sensorial way. Perceptive codification would give rise to superficial, hard-to-recover mnemonic features.

There is currently a consensus regarding the existence of memory alterations in schizophrenia.²⁷⁻²⁹ In addition, such disturbances seem to be little sensitive (or even refractory) to treatment with conventional³⁰ or new generation antipsychotics³¹ and are related to the course and prognosis of the syndrome.³² However, some questions remain unanswered. For example: are the mnemonic deficits that accompany schizophrenia global or selective? What are the functional mechanisms responsible for the disturbances observed? What are the repercussions of memory alterations at the most integrated levels of cognitive functioning, principally in the links between memory and consciousness? Do the most subtle deficits, not evaluated by classical neuropsychological tests, respond to pharmacotherapy? Due to their clinical and therapeutic importance, these and other issues have been investigated with ever-increasing frequency.

The main objective of this study was to adapt the method proposed by Tulving³ and later modified by Gardiner and Java,⁵ which is designed to evaluate the states of consciousness that accompany the recognition of a previously presented stimulus, for use in Portuguese-speaking patients with schizophrenia. The method involves self-evaluation of the states of consciousness and is therefore designated "first person accounting", complementing formal evaluations⁷ and making it possible to better understand some long-standing questions.

In addition, it was our intention to ascertain whether the material developed lends itself to determining the effect of the level of processing in healthy volunteers.

Methods

In order to reach the desired objectives, it was necessary to construct a word list in Portuguese, as well as to develop instructions that would allow the manipulation of the level of information processing and the application of the method in healthy volunteers, mainly in patients with schizophrenia, in order to determine whether they would be able to understand what was expected of them and respond as instructed.

The project was approved by the Ethics in Research Committee of the Universidade de São Paulo at Ribeirão Preto School of Medicine Hospital das Clínicas. All subjects gave written informed consent, acknowledging the voluntary nature of their participation and the possibility of dropping out with no adverse consequences.

1. Word list

Two lists were made, each consisting of 40 words selected on the basis of a one-month study of the frequency of occurrence of words in the *Folha de São Paulo* newspaper (Françoso E.,

unpublished data*). The words were common, concrete nouns in common usage. The two lists were developed in a way that would guarantee equality in the number of letters and syllables in each word, thereby ensuring that the length of the words would not interfere with the acquisition/recollecting process.

Each of the words was printed on a self-adhesive label fixed on a card (16 cm × 11 cm) in capital letters, using the Times New Roman font in a 36-point typeface. On the back of each card, another label, onto which we printed the number of the list to which the word belonged (list 1 or list 2) and the number that indicated its position in the order of presentation of the words, using the same font in a 14-point typeface, was affixed. Another label was also affixed to the back of the card. Onto that label, we printed the instruction corresponding to the word in question, using the same font in a 22-point typeface, in capital letters: "count the letters" (favoring perceptive codification); or "form a phrase" (instead giving rise to semantic codification).

The numerical sequence of the presentation of the words was developed so that the same instruction was not repeated more than twice in succession. In each list, half of the instructions were to count letters, and the other half were to make phrases. These details aimed at neutralizing factors that might interfere with the application process and therefore hinder the interpretation of the results.

The recognition list consisted of 80 words (40 on each list), so that the words presented to one group in the learning phase would be new words for the other group. On this list, the words were also written at random on A4-size paper, displayed in four 10-word columns printed on each side of the sheet.

An abbreviated version of the list was also created, consisting of 6 words only and printed on labels having the same characteristics as those used for the learning lists, to be used as an exercise to check whether the instructions had been understood. For this exercise, a small recognition list was also created, containing these 6 words and 6 more, in a random but constant sequence. All of this material is available upon request.

2. Instructions

The instructions were translated and adapted from those used in previous studies in which the same evaluation procedure had been adopted.^{5,7-8,20}

During the 15-minute break between the learning and testing phases, oral and written instructions for the performance of the task were given. The page of written instructions was held by the subjects for occasional reference, if necessary, during the performance of the task. Next, for training and clarification purposes, the 6-word exercise list cards were presented to the volunteers, with the same instructions – form phrases, with 3 words, and count the letters of the other 3 words. Immediately after the presentation of this 6-word list, the subjects were asked to follow the instructions on the recognition list, which contained 12 words, as an exercise. After performing the recognition task, subjects were instructed to justify each of their "R" responses. That gave subjects the opportunity to ask question and gave the instructors a chance to determine whether the instructions had been clearly understood.

Upon recognition that a word from the 80-word list was on the list of words presented in the learning phase, the volunteers were instructed to circle the word and write next to it the letter indicating one of the three possible responses ("R", "K" or "G").

Examples of routine situations, in which differences between conscious recollection and feelings of familiarity could be noticed, were also given. One such situation was seeing, on the street, a

person that one knows well and remembering other events involving that person, such as where and when that person was last encountered, what was discussed at the time, etc. (conscious recollection). Another situation was seeing and recognizing such a person but not remembering from where one knows that person or having any recollections that might help contextualize the memory (feelings of familiarity). In the third situation, the subject sees a person on the street but is not sure whether they know the person or not.

3. Training

Once the material was ready – and after adaptation of the instructions – it was used with three healthy volunteers, with the objective of training the researchers/instructors with the material and familiarizing them with the material.

4. Application in healthy volunteers

The next step was the application of the method to a group of healthy volunteers. If the instructions were adequate and had been well understood, one would expect greater recognition of words with which the volunteers had formed phrases, compared to those for which the instruction had been to count the number of letters (processing level effect). In addition, one of the objectives was to determine whether there would be a greater number of "R" responses associated with the instruction "form a phrase", which would demand more elaborate treatment of the stimulus presented.

This group involved six healthy volunteers (four females and two males; mean age, 35.4 years old; range, 22-58 years), considered healthy because they presented no physical abnormalities that might interfere with their performance of the tasks, no history of psychiatric treatment, no history of alcohol or drug abuse and no current use of any sort of medication.

5. Application in patients

With the objective of determining subject capacity to understand and execute the task, the test was applied to six patients with schizophrenia (four males and two females; mean age, 36.6 years old; range, 29-44 years), according to the criteria of the American Psychiatric Association - DSM-IV.³³ Patients who had been under pharmacotherapy, started within the preceding four weeks, as well as those presenting scores equal to or higher than 2 on any item of the British Psychiatric Rating Scale,³⁴ except emotional withdrawal, psychomotor retardation, inappropriate affection or withholding of affection (all related to negative symptoms of the disease), were excluded from this study.

6. Data analysis

Absolute values were converted into percentages, which facilitates interpretation of the results. Comparisons were made using the Wilcoxon signed rank test, a nonparametric statistical test for ordinal data and paired groups. It should be noted that each group was compared with itself in terms of the proportion of correct responses based on the instructions and in terms of the proportions of "R", "K" and "G" responses, also according to the instructions. No comparisons were made between the groups due to their questionable validity (they were not paired and were not evaluated in the same period of time).

Results

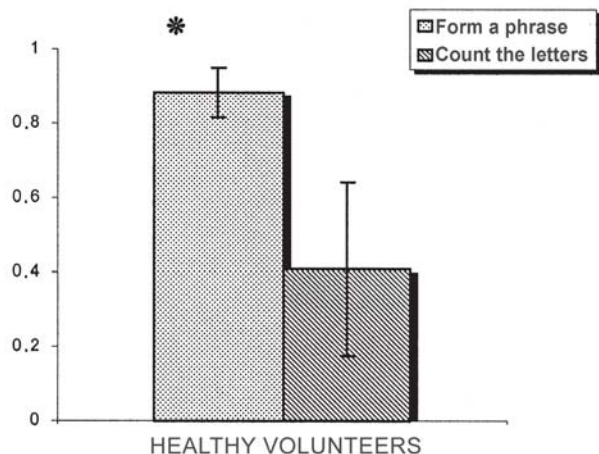
1. Proportions of correct recognitions

1) Healthy volunteers

Words for which the instruction given had been "form a phrase"

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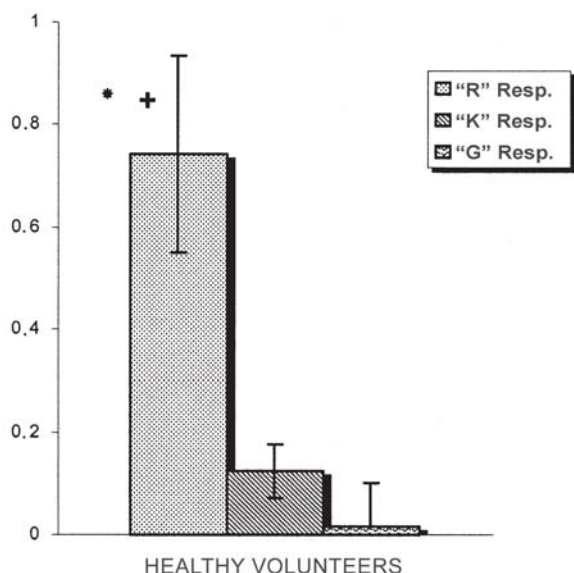
were recognized in greater proportions than were those for which the instruction had been "count the letters" ($p = 0.028$) – Figure 1.



* = $p < 0.05$

Figure 1 – Mean proportions of recognitions by type of instruction among healthy volunteers

Words for which the instruction given had been "form a phrase" garnered a higher mean number of "R" responses than of "K" or "G" responses, as can be seen in Figure 2 (below). The Wilcoxon signed rank test showed a significant difference between R and K ($p = 0.028$) and between R and G ($p = 0.027$) but not between K and G ($p = 0.066$).



* = $R > K; p < 0.05$

+ = $R > G; p < 0.05$

Figure 2 – Mean proportions of responses with the instruction "form a phrase" among healthy volunteers

The proportions of "R", "K" and "G" responses related to words for which the instruction given had been "count the letters" did not differ statistically (R vs. K: $p = 0.223$; R vs. G: $p = 0.206$; K vs. G: $p = 0.257$) – Figure 3 –, indicating that recognition based on feelings of familiarity was not influenced by the manipulation of the level of information processing.

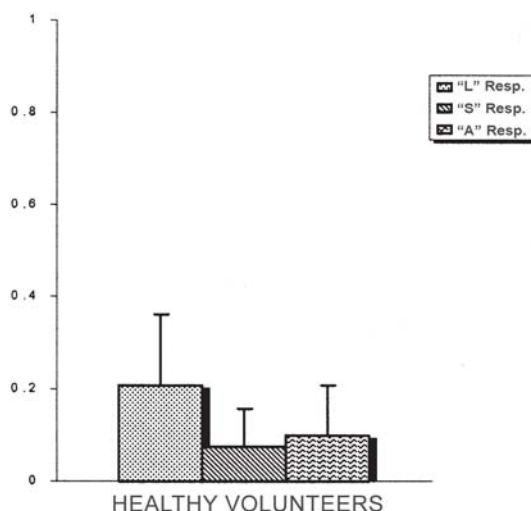
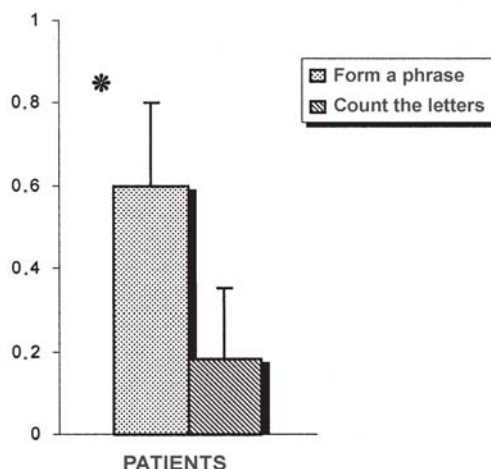


Figure 3 – Mean proportions of responses with the instruction "count the letters" among healthy volunteers

In this test, the processing level effect is brought into focus when it is observed that the instruction ("form a phrase" vs. "count the letters") interfered only with the "R" responses ($p = 0.027$) and not in the "K" ($p = 0.461$). There was also a difference in the proportion of "G" responses ($p = 0.042$).

2) Patients

In the group of patients, we observed that the proportion of recognized words for which the instruction given was "form a phrase" was greater than that of recognized words for which the instruction given was "count the letters" ($p = 0.027$) – Figure 4.



* = $p < 0.05$

Figure 4 – Mean proportions of recognitions by type of instruction among patients

For the “form-a-phrase” words, there was a greater proportion of “R” responses than of “K” ($p = 0.027$) or “G” ($p = 0.028$) responses. No such difference was found between “K” and “G” responses ($p = 0.671$) – Figure 5.

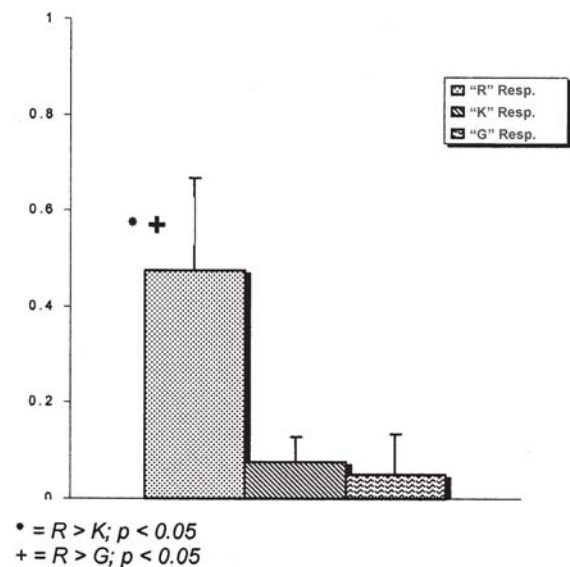


Figure 5 – Mean proportions of responses with the instruction “form a phrase” among patients

Among the patients, very similar mean proportions were observed for the group of words in which the instruction given was “count the letters”, (R vs. K: $p = 0.588$; R vs. G: $p = 0.357$ and K vs. G: $p = 0.671$) – Figure 6.

Among the patients, it was also evident that the type of instruction interfered with the “R” responses ($p = 0.027$) but not with the “K” ($p = 0.581$) or “G” responses ($p = 0.655$); that is, the phenomenon referred to as the processing level effect also affected the patients.

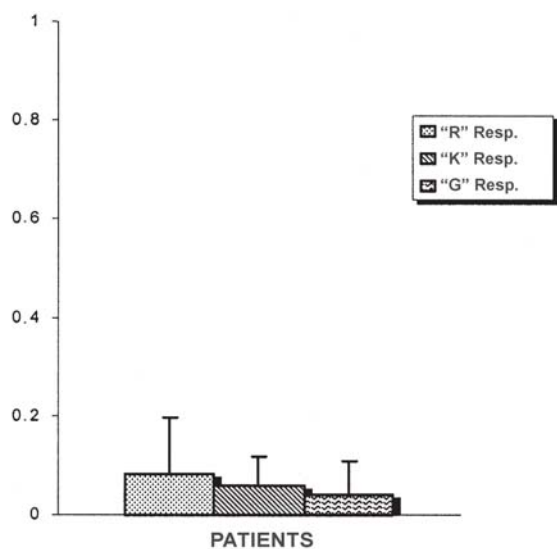


Figure 6 – Proportion of answers with the instruction “count the letters” among patients

2. Incorrect recognitions

1) Healthy volunteers

A total of 14 words not presented in the learning phase were recognized by four of the six healthy volunteers. As normally occurs in this population, these incorrect recognitions were accompanied by “K” responses (8) or “G” responses (6), that is, by feelings of familiarity or even doubt about whether the word had been presented or not.

2) Patients

A total of 17 words not presented in the learning phase were recognized by four of the six patients. Among these incorrect recognitions, there were various “R” responses (10), that is, conscious recollection of something that did not happen, a phenomenon previously described in patients with schizophrenia.³⁵

Discussion

Since soon after having been proposed, the method of self-evaluating states of consciousness that accompany recognition, together with the subjacent cognitive hypothesis, has proven to be quite resistant to various experimental manipulations and useful in devising more in-depth studies of memory alterations in patients with schizophrenia, even allowing the outline of hypotheses regarding its functional mechanisms and its clinical significance.³⁵⁻³⁶

This study produced two main results. First, as predicted, the material and the manipulation of the presentation of the data to change the level of information processing in the learning phase permitted the reproduction, in healthy volunteers, of a basic and well-known finding, referred to as processing level effect.²⁶ The “form-a-phrase” instruction demands that the word be inserted into a context, thereby favoring more elaborate cognitive treatment, in the same way as the search for a word related to the word presented in the learning phase of the pioneering study conducted by Gardiner and Java.⁵ However, the “count-the-letters” instruction favors perceptive processing in an even more direct way than the instruction to find a rhyme to a word presented in the learning phase, a strategy used in previous studies.^{5,25} It is supposed that the memory traits created as a result of more elaborate treatment are deeper and more complex (and therefore richer and more fixed) than are the sensorial traits, which would explain the greater recognition of words for which the instruction was to form sentences than of those for which the instruction was to count the letters. In addition, even among the healthy volunteers, there was a greater proportion of “R” responses related to the words for which the instruction was “form a phrase” than related to the words for which the instruction was “count the letters”, without resulting in a great change in the proportion of “K” responses, a clear reproduction of the phenomenon initially described by Gardiner and Java⁵ and later reproduced by other authors.^{13,25,37} This dissociation of the responses in relation to the instruction (of the level of processing) obtained in our study validates the adaptation to Portuguese of the material and of the method.

The second important result is that the schizophrenic patients were capable of understanding what was expected from them and performed the proposed task in all its phases (learning, recognition, identification of associated states of consciousness, and justification of the “R” responses). As previously described, in order to obtain this result, a checking exercise, in which it was possible to detect any failures of comprehension, was performed immediately after the instructions had been given. In addition, it must be borne in mind that, despite being apparently complicated, the method proposed by Tulving is based on common everyday experiences, is relatively rapidly applied and not very

tiring – the learning phase lasts approximately 3 minutes, giving the instructions takes approximately 15 minutes, and the test phase is carried out without any time pressure, subjects being allowed to work at their own rhythm.³ Patients with schizophrenia are capable of performing neuropsychological tests that are much more elaborate and tiring.³⁸⁻³⁹ Last but not least, whoever works with schizophrenic patients knows that, generally speaking, their engagement in performing the tasks is outstanding, a fact that was also noticed in the present study.

An additional finding was that the processing level effect was also seen in the group of the schizophrenic patients, including the greater proportion of “R” responses related to the words for which the instruction was “form a phrase”. This leads us to think that this adapted method may be applied to larger groups of patients, with the objective of better characterizing the state of consciousness alterations accompanying recognition in schizophrenia and determining their clinical and therapeutic implications.

The healthy volunteers and the schizophrenic patients alike made incorrect recognitions. Among the healthy volunteers, these recognitions were accompanied only by “K” and “G” responses. Gardiner et al. called attention to the fact that incorrect recognition accompanied by an “R” response is rare in healthy volunteers. The authors found that patients, in contrast, made various incorrect recognitions accompanied by “R” responses. The patients were certain that those words had been presented in the learning phase, and they remembered having made some sort of association with these words, although they had not been seen.⁴⁰ In other words, some patients clearly remembered something that did not happen. A similar phenomenon was described by Huron et al., who considered it more as an indicator of qualitative disturbance of the conscious recollection in schizophrenia.³⁵

In conclusion, the results obtained suggest that the adaptation to Portuguese of the method of self-evaluating states of consciousness that accompany recognition was found to be sensitive to manipulation of the level of information processing in healthy volunteers and can be applied in patients with schizophrenia.

Conclusion

No direct comparisons were drawn between the groups in the present study. However, the results obtained suggest that the adapted form of the method may be applied in the future in quantitative comparative studies of the phenomena observed herein in populations of healthy volunteers and patients with schizophrenia, provided that the groups are similar to each other regarding variables that may influence the results, such as gender, age, schooling and IQ. This would also make it possible to compare the effect of the level of information processing on recollection in the different groups. In addition, the use of this method opens the way to the evaluation, in different groups of schizophrenic patients, of the influence of factors such as the treatment applied, clinical presentation and duration of the memory disorder and of the disorder related to the states of consciousness accompanying recollection.

Finally, further studies using this approach will help characterize alterations in memory and consciousness in schizophrenia, as well as to gauge their clinical and therapeutic implications.

References

- Glenberg AM. What memory is for. *Behav Brain Sci.* 1997;20(1):1-55.
- Tulving E. Organization of memory. Quo vadis? In: Gazzaniga MS, editor. *The cognitive neurosciences.* Cambridge: MIT Press/Bradford Books; 1995. p. 839-47.
- Tulving E. Memory and consciousness. *Can Psychology.* 1985;26(1):1-12.
- Baddeley AD. *Human memory – theory and practice.* East Sussex (UK): Psychology Press; 1997.
- Gardiner JM. Functional aspects of recollective experience. *Mem Cognit.* 1988;16(4):309-13.
- Gardiner JM, Java RI. Recognition memory and awareness: an experiential approach. *Eur J Cogn Psychol.* 1993;5:337-46.
- Gardiner JM, Java RI, Richardson-Klavehn A. How level of processing really influences awareness in recognition memory. *Can J Exp Psychol.* 1996;50(1):114-22.
- Gardiner JM, Richardson-Klavehn A, Ramponi C. On reporting recollective experiences and “direct access to memory systems”. *Psychological Sci.* 1997;8(5):391-4.
- Curran T. Brain potentials of recollection and familiarity. *Mem Cognit.* 2000;28(6):923-38.
- Düzel E, Yonelinas AP, Mangun GR, Heinze HJ, Tulving E. Event-related brain potential correlates of two states of conscious awareness in memory. *Proc Natl Acad Sci USA.* 1997;94(11):5973-8.
- Henson RN, Rugg MD, Shallice T, Josephs O, Dolan RJ. Recollection and familiarity in recognition memory: an event-related functional magnetic resonance imaging study. *J Neurosci.* 1999;19(10):3962-72.
- Curran HV, Gardiner JM, Java RI, Allen D. Effects of lorazepam upon recollective experience in recognition memory. *Psychopharmacology (Berl).* 1993;110(3):374-8.
- Dewhurst SA, Hitch GJ. Cognitive effort and recollective experience in recognition memory. *Memory.* 1999;7(2):129-46.
- Gardiner JM, Java RI. Recollective experience in word and nonword recognition. *Mem Cognit.* 1990;18(1):23-30.
- Gardiner JM, Java RI. Forgetting in recognition memory with and without recollective experience. *Mem Cognit.* 1991;19(6):617-23.
- Gardiner JM, Java RI. Recognition memory and awareness: an experiential approach. *Eur J Cogn Psychol.* 1993;18(1):23-30.
- Gardiner JM, Parkin AJ. Attention and recollective experience in recognition memory. *Mem Cognit.* 1990;18(6):579-83.
- Gardiner JM, Gawlik B, Richardson-Klavehn A. Maintenance rehearsal affects knowing not remembering; elaborative rehearsal affects remembering not knowing. *Psychonom Bull Rev.* 1994;1:107-10.
- Gregg VH, Gardiner JM. Components of conscious awareness in a long-term modality effect. *Br J Psychol.* 1991;82:153-62.
- Hetem LA, Danion JM, Diemunsch P, Brandt C. Effect of a subanesthetic dose of Ketamine on memory and conscious awareness in healthy volunteers. *Psychopharmacology (Berl).* 2000;152(3):283-8.
- Huron C, Giersch A, Danion JM. Lorazepam, sedation, and conscious recollection: a dose-response study with healthy volunteers. *Int Clin Psychopharmacol.* 2002;17(1):19-26.
- Java RI, Kaminska Z, Gardiner JM. Recognition memory and awareness for famous and obscure musical themes. *Eur J Cogn Psychol.* 1995;7:41-53.
- Mogg K, Gardiner JM, Stavrou A, Golombok S. Recollective experience and recognition memory for threat in clinical anxiety states. *Bull Psychon Soc.* 1992;30:109-12.
- Parkin AJ, Walter BM. Recollective experience, normal aging, and frontal dysfunction. *Psychol Aging.* 1992;7(2):290-8.
- Rajaram S. Remembering and knowing: two means of access to the personal past. *Mem Cognit.* 1993;21(1):89-102.
- Craik FIM, Lockhart RS. Levels of processing: a framework for memory research. *J Verbal Learn Verbal Behav.* 1972;11:671-84.
- Aleman A, Hijman R, de Haan EH, Kahn RS. Memory impairment in schizophrenia: a meta-analysis. *Am J Psychiatry.* 1999;156(9):1358-66.
- Danion JM, Peretti S, Gras-Vincendon A, Singer L. [Memory disorders in schizophrenia]. *Encephale.* 1992;18(2):315-28. French.

29. Stip E, Lussier I. The heterogeneity of memory dysfunction in schizophrenia. *Can J Psychiatry*. 1996;41(7 Suppl 1):S14-20.
30. Medalia A, Gold J, Merriam A. The effects of neuroleptics on neuropsychological test results of schizophrenics. *Arch Clin Neuropsychol*. 1988;3(3):248-71.
31. Keefe RS, Silva SG, Perkins DO, Lieberman JA. The effects of atypical antipsychotic drugs on neurocognitive impairment in schizophrenia: a review and meta-analysis. *Schizophr Bull*. 1999;25(2):201-22.
32. Green MF. What are the functional consequences of neurocognitive deficits in schizophrenia? *Am J Psychiatry*. 1996;153(3):321-30.
33. American Psychiatric Association. Diagnostic and statistical manual of mental disorders DSM-IV, 4th ed. Washington (DC): APA; 1994.
34. Overall JE, Gorham DR. The brief psychiatric rating scale. *Psychol Rep*. 1962;10:799-812.
35. Huron C, Danion JM, Giacomoni F, Grange D, Robert P. Impairment of recognition memory with, but not without, conscious recollection in schizophrenia. *Am J Psychiatry* 1995; 152:1737-42.
36. Danion JM, Rizzo L, Bruant A. Functional mechanisms underlying impaired recognition memory and conscious awareness in patients with schizophrenia. *Arch Gen Psychiatry*. 1999;56(7):639-44.
37. Java RI, Gregg VH, Gardiner JM. What do people actually remember (and know) in "remember/know" experiments? *Eur J Cogn Psychol*. 1997;9:187-97.
38. Schroder J, Tittel A, Stockert A, Karr M. Memory deficits in subsyndromes of chronic schizophrenia. *Schizophr Res*. 1996;21(1):19-26.
39. Weickert TW, Goldberg TE. The course of cognitive impairment in patients with schizophrenia. In: Sharma T, Harvey P, editors. *Cognition in schizophrenia. Impairment: importance and treatment strategies*. Oxford: Oxford University Press; 2000. p. 4-15.
40. Gardiner JM, Ramponi C, Richardson-Klavhen A. Experiences of remembering, knowing, and guessing. *Conscious Cogn*. 1998;7(1):1-26.