

Improvement of Autobiographical Memory in Schizophrenia Patients Following a Cognitive Intervention: A Preliminary Study.

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Abstract

Background: Schizophrenia is associated with a reduction in accessing specific autobiographical information. This is consistent with the abnormal development of the personal identity characterizing this mental disorder. The present study evaluates the effect of a cognitive intervention on autobiographical memory and on the capacity to project oneself in the future in people suffering from schizophrenia.

Sampling and Method: The intervention consisted of group sessions during which participants were trained to recollect specific events reported in their diary. Further, exercises to stimulate their thoughts on their personal identity were proposed. An AM test was administrated before and after the intervention, as well as at three months follow-up. Further, neuropsychological and affective assessments were conducted before and after treatments. Patients' performances were compared to those from the control group

Results: The capacities to generate specific events are improved by the cognitive intervention, and that the benefits are preserved 3 months later. However, no neuropsychological or affective benefit was found.

Conclusion: Despite positive results on specific memory, the significant benefits have to be extended to other clinical variables such as symptom reduction, neuropsychological and social functioning. Nevertheless, the results revealed that CRT on AM could be a useful additional intervention for schizophrenia patients.

Key words: schizophrenia, autobiographical memory, self-identity, therapy, cognitive intervention.

Improvement of Autobiographical Memory in Schizophrenia Patients Following a Cognitive Intervention: a Preliminary Study.

The present clinical trial was inspired by the theoretical model of schizophrenia of Danion and collaborators [1, 2]. This model postulates cognitive deficits common to all types of schizophrenia, consisting of a lack of specificity in the recollection of autobiographical memories (AM) and deficits of autonoetic awareness. These impairments would be related to a disturbed sense of self and/or poor personal identity. The purpose of the present clinical intervention was to increase the ability of schizophrenia patients to generate specific autobiographical material using a cognitive remediation therapy (CRT) combined with the principles of cognitive and behavioural therapy (CBT), in a group setting. To provide the theoretical foundation of the present intervention, the model of schizophrenia of Danion and collaborators and supportive evidence will be presented.

Schizophrenia is accompanied by disturbances in AM. These disturbances can take the form of an over-general retrieval style: Individuals with schizophrenia instructed to recall a specific event distinctly located in time and place (e.g., "the visit of my best friend, at home the last monday") actually recall an extended event (e.g., 'my undergraduate days'), or a category of repeated events (e.g., 'when I visit my friend') [3]. Feinstein and collaborators [4], comparing autobiographical memories of 19 schizophrenia patients to those of 10 controls, reported deficits in both personal episodic (events) and semantic memories (facts) in schizophrenia patients. Their recall was poorest for the early adult period, which is the period related to the onset of the disease. Their recall from childhood was the least impaired. In normal individuals, no difference between the life periods emerged. The authors hypothesized that the normal processes of encoding or consolidation could have been disrupted by the period of acute illness. The finding of deficit in specific AM in schizophrenia patients has been largely reported across the different type of schizophrenia [5, 6, 7, 8, 9, 10]. Further, based on evidences that AM retrieval and thinking of the future share common processes [11,12], Neumann (unpublished doctoral thesis) has hypothesized that

schizophrenia patients should also present difficulties in imagining specific events that might happen to them in the future, and that specificity levels for past and future events should be correlated. The author found results that confirmed both hypotheses.

From a theoretical point of view, when specific memories are accessed in the autobiographical knowledge base, retrieval is accompanied by a subjective experience also called autonoetic awareness [13]. Autonoetic awareness is the kind of awareness experienced by normal individuals who consciously recollect personal events by reliving them mentally [14, 15]. Therefore, the recollection of the specific details of the encoding context characterizes autonoetic awareness lead to the recall of a specific autobiographical event located in time and space. As a consequence, patients who show difficulties in retrieving specific events in an episodic or autobiographical memory tasks also should exhibit poor performance in the generation of contextual details that support autonoetic awareness. Results from studies in depressed [16, 17] and schizophrenia patients [9, 10] support this hypothesis. According to Danion and collaborators [18], the impairment of autonoetic awareness in schizophrenia results from a failure of the strategic processes that bind the separated aspects of the event to be recollected, such as the content of the event and its contextual characteristics (i.e, where, when, and how the event occurred). They have suggested that, when schizophrenia patients establish links within events, these links are not strong enough to promote high levels of autonoetic awareness. Further, when the binding of the different aspects of an event is weak, recall will be less efficient. These forms of impairment in encoding and recalling information would dampen the ability to mentally relive personal past events [2, 18]. Previous research has shown that the ability to organize information for remembering in an intentional and strategic way is impaired in schizophrenia patients [18, 19, 20], and that the remembering is accompanied by a low level of autonoetic awareness [10, 18, 21]. The impairment of autonoetic awareness in schizophrenia could play a fundamental rule in the development and the expression of the disease. Indeed, autonoetic awareness allows individuals to relive past experiences with a feeling of individuality as well as to know the difference between an event, a thought, a fantasy experienced by someone else

and their past personal life. It entails travel in time, allowing the individual to mentally go back in the past and to make predictions for the future. This kind of consciousness is closely related to the “self” and one’s uniqueness. Autonoetic awareness enables individuals to think about their thoughts, feelings, actions, and social relationships. It makes memories unique and allows individuals to place themselves in the context of their personal life history. Consequently, autonoetic awareness is also crucial to the construction of personal identity.

According to Conway & Pleydell-Pearce [13], AM is also an inherent part of personal identity and is strongly related to its development. They link the notions of AM and self, and provide a theoretical background for investigating the abnormalities in the construction of self in schizophrenia [2]. They have developed a motivational approach to AM that stresses the impact of desires, emotions and the construction of self. Individuals are inclined to memorize facts that are congruent with their current self-views. The relationship between AM and the self is reciprocal. Autobiographical knowledge restricts the range of goals that an individual can hold in mind. The goals that are not congruent with their autobiographical knowledge cannot be pursued by individuals. One function of AM is thus to construct the self. The idea that there is a fundamental disruption in the sense of self-identity and/or poor self-identity in schizophrenia is largely put forward by theoretical models [2, 22, 23, 24], and empirical studies support this idea [25, 26, 27].

In sum, the theoretical model of Danion postulates that specific AM, autonoetic awareness, and the construction of self are related, and that schizophrenia is a mental disorder characterized by impairment on these three levels. These forms of cognitive impairments seem to be a core problem in schizophrenia. However, to our knowledge, no intervention on these cognitive deficits has been proposed, to date. The purpose of the present study was to test a therapeutic intervention efficacy to enhance the capacities of schizophrenia patients to generate specific personal memories. Specifically, the goals were (1) to investigate AM as well as the capacities to project oneself in the future in patient with schizophrenia, and (2) to evaluate the programme long-term efficacy. To this end, schizophrenia patients were trained to complete a diary every day. For each reported event,

patients were trained to connect the events to the self by reporting their feelings and thoughts related to the event and by evaluating the importance of the self-relevance of the event. They performed repeated exercises in remembering events reported in the diary, and in reflecting upon their self-definition and goals. The CRT was conducted in a group setting. In order to test the intervention efficacy, the patients' ability to generate specific past and future events before and after the intervention were compared to the performances from a control group of patients following another therapeutic program targeting psychoeducation about the disease or conversation training.

Method

Participants

Fifteen patients have completed the AM intervention while 12 have completed the control intervention¹. The clinical interventions were conducted within two psychiatric hospitals. Seventeen patients were from the chronic inpatient population of a public psychiatric hospital and 10 patients were from the chronic outpatient population of another psychiatric hospital. All participants fulfilled the DSM-IV criteria [28] for chronic schizophrenia confirmed by two psychiatrists and they had been clinically stabilized for several months. They were medicated by either typical or atypical antipsychotic drug, antiparkinsonian drug, antidepressant drugs, and benzodiazepines. Exclusion criteria were (1) current problem of alcoholism or other drug abuse, (2) organic cerebral diseases, and (3) plans to change medication during the treatment phase. The protocol was approved by the ethical committees of the two hospitals where the patients were recruited. After a complete description of the study to the participants, they provided written consent to use the data for scientific investigations and communications. Table 1 summarizes demographic and clinical characteristics of the population. The participants' social functioning was assessed using the Global Assessment of Functioning scale [28], and the clinical characteristics were assessed using a French version of the Brief Psychiatric Rating Scale [29]. No significant difference between the two groups emerged on the demographic and clinical characteristics.

¹ In each group, 3 patients dropped out after one or two sessions.

Insert Table 1 about here

Dependant measures

Autobiographical Memory Test (AMT):

Task for past events

A validated French version (Neumann & Philippot, unpublished manuscript) of the AMT [19] was used. Participants were required to retrieve specific personal events in response to cue words. It was explained that a specific memory refers to a particular event from the past that happened to them personally at a particular place and time, and that did not last longer than a day [27]. Ten cue words, five positive and five negative were presented to participants. For each word cue, participants had one minute to provide a brief written report of a personal event. Specifically, participants were asked "Can you recall a personal event that the word...evokes?".

Task for future events

A French version of the Future Cuing task developed Williams and collaborators [19] was used. This task replicates the AMT, except that, instead of retrieving past events, participants are instructed to imagine events that could occur to them in the future. Participants were explained that the future events imagined had to be specific. It was also mentioned that the future events had to be realistic. Ten words were used as cues, five positive and five negative. For this version, participants were asked "Can you report a future personal event that the word ...evokes?"

The ten word cues employed in the task of past events before treatment were employed as word cues in the task for future events after treatment. In the same way, the ten word cues employed in the task for future events before treatment were employed as word cues in the task for past events after treatment.

For both task, in order to familiarize the participants with the procedure, they were asked to complete two practise trials during which the experimenter checked their understanding of

the procedure. Responses were coded as 'specific' if a single event was recalled, located in time and place and lasting no more than a day. An extended event, a category of repeated events or no response within the time limit (60 s.) were considered as a failure. The evaluator was blind to group allocation.

Executive functions measures

A neuropsychological test battery was applied before and after treatments to assess the participant's cognitive functioning. The verbal Letter Fluency task [32], the Digit Span Test, forward and backward orders (WAIS-III) [33] and the Stroop Colour-Word Test [34] were administrated because these tests measure executive functions.

Intensity of affective symptoms

The Beck Depression Inventory [35] was used to assess levels of depressive symptomatology. Data were lost for two participants in the control group. The Y-A form of the French version of the Spielberger Inventory [36] was administered to measure the intensity of anxiety felt at the present moment. Data were lost for one participant in the AM group. Participants completed these questionnaires before and after treatment.

Content of the interventions

The clinical interventions consisted of 10 weekly 1h30 group sessions, conducted by 2 therapists. In both hospitals, one of the two therapists was a certified CBT therapist.

Autobiographical Memory Intervention:

The therapists were trained by the two first authors. During sessions, the therapists' interventions aimed at eliciting in participants the elaboration of specific autobiographical materials (located in time and context).

First session: The intervention started with a discussion on the symptoms of schizophrenia (positive symptoms, negative symptoms, cognitive symptoms). To illustrate impairment in memory, each participant was asked to recall what he or she had done the previous Wednesday with as much details as possible. Then, the therapists introduced and explained the notions of AM and personal identity. The therapists explained that the aim of the present therapeutic group was to improve the participant's autobiographical memories

using a diary, and that the procedure would be explained in detail in the next session. Finally, the French version of the AMT was administered.

Second session: Each patient received a diary. In order to familiarize participants with the diary, one practise trial was proposed. All participants were asked to report a personal event that had occurred the day before and afterwards to relate the events to other participants. Participants were informed that, during the following sessions, diaries would be exchanged among them, and that they would question each other about the content of their diaries. Participants were thus invited to report personal events that could be shared with others.

Third session: The diaries were exchanged among participants and they questioned one another. Then, a game was proposed in which points would be attributed as a function of the number of recalled details. In this context, participants were asked to remember diary events several times. After the game, the session continued with a discussion on personal goals in life. Each participant was asked "What would you like to do in the near future?" Finally, the future cuing task was administered with a different series of words than the series used for the AM.

Fourth session: As in the previous session, diaries were exchanged and questions were asked. Further, diaries from the previous session were distributed, and participants were invited to question their partner. All the following sessions started with these remembering exercises. Then, the session continued with a discussion on personal identity. The therapists reminded the participants of the notion of personal identity and its relationship to motivation. An exercise on self-definition was proposed (Conway, personal communication 17/02/2004). Participants were asked to report three self-defining adjectives. In order to stimulate the self-definition as well as the remembering of personal events, participants had to recall a specific personal life event that illustrates one of the adjectives. Participants were also asked to report adjectives defining the other participants and to recall again a specific personal event that illustrates the adjective. Finally, as homework, participants had to

provide two specific personal events illustrating each of the two remaining self-defining adjectives.

Fifth session: After the remembering exercises, the session continued with a discussion on personal identity. Another exercise on self-definition was proposed. The participants were asked to define their role(s) in life and to recall specific personal life events that illustrated those role(s).

Sixth session: After the remembering exercises, the session continued with a discussion on personal goals in life. Participants reflect upon their goals for the near future. The therapists underlined that personal goals are often in line with roles and self-definition. The participants exchanged ideas on the steps to reach some goals, and they were encouraged to actively pursue them.

Seventh session: After the remembering exercises, the session continued with a discussion on the steps needed to reach the goals. Each participant revealed to the others the steps they themselves had taken. To motivate participants to take the requested steps, the therapists proposed an exercise. Participants were asked to project vividly themselves into a situation related to the goal they wanted to reach. They had to describe the situation (where, when, with whom, what they would think, what they would feel).

Eighth and ninth session: After the remembering exercise, the session continued with a discussion on personal goals.

Tenth session: After the remembering exercise, the session continued with a discussion on the intervention. Finally, participants were asked to complete the AM test with the series of words used during the task for future event completed before intervention.

During the days after, participants were asked to complete the task for future event with the series of words used during AM test completed before intervention.

Control Intervention

Controls patients took part in interventions targeting either psychoeducation about schizophrenia disorder or conversation training. These interventions consisted of 1h30 group sessions, conducted by the CBT experienced therapist who conducted the AM group and

another therapist. As for the AM group, the sessions took place once a week for 10 weeks and the therapists applied the principles of CBT. The tests were administered using the same schedule than the one used for the AM group.

Results

Autobiographical memory specificity

The numbers of specific events generated before and after the interventions are shown in Table 2. A mixed design 2 (group) \times 2 (time) \times 2 (task) ANOVA was conducted on the number of generated specific events. Means for this analysis are shown in Table 2. The analysis revealed significant main effects of group and time ($F(1,25) = 6.20, p = .02, \eta^2 = 0.198$; and $F(1,25) = 30.86, p < .001, \eta^2 = 0.55$, respectively). Inspections of means shown that the AM group was more specific than the control group and that participants was more specific after the treatments than before the treatments ($m = 4.31, sd = 1.76$ and $m = 6.00, sd = 2.17$, respectively). These main effects were qualified by a significant group by time interaction $F(1,25) = 5.08, p = .033, \eta^2 = 0.168$. In line with our hypothesis, post-hoc analyses showed that no significant difference between groups emerge before treatments while participants in the AM group report more specific autobiographical material than the control group after the clinical interventions ($t(25) = 1.40, ns$; $t(25) = 3.06, p = .005, \eta^2 = 0.225$; for before treatment and after treatment, respectively). No significant main effect or interaction involving task emerged

Insert Table 2 about here

For each patient, the content of the events reported at post-tests was compared to the content of the events reported at pre-tests for past and future events, and was compared to the content of the events reported in the dairies. The comparisons showed that participants recollected different personal events, excepted for one event by one participant for the AM test. Thus, the observed difference in scores cannot be accounted for by an improvement of memory for the events rehearsed during sessions.

Executive functions measures

A mixed design 2 (group) \times 2 (time) ANOVA was conducted on each neuropsychological measure. Means for these analyses are shown in Table 3. For the Verbal Fluency Task, no significant main effect or interaction emerged. For the Stroop Color-Word Test, the analysis revealed a significant time by group interaction $F(1,25) = 5,88$, $p = .022$. Inspection of means revealed that the AM group tend to performed better after treatment than before while the reverse was found for the control group. For the Digit Span Test, backward order, no significant main effect or interaction emerged while for the forward order a main effect of group was found $F(1,25) = 5,16$, $p = .031$. Inspection of means shown that the AM group performed higher than the control group.

Intensity of affective symptoms

A mixed design 2 (group) \times 2 (time) ANOVA was conducted on the scores of each questionnaire. Means for these analyses are shown in Table 3. For the two questionnaires, no significant main effect or interaction was found.

Insert Table 3 about here

Relationships between memory specificity and demographic and clinical characteristics

Associations between memory specificity and clinical and demographic variables were assessed with Pearson correlation coefficients. No significant correlations were found between specificity (number of specific AM, number of specific future events evaluated before, after treatment and 3 months after) and age, level of education, social functioning, illness duration, and psychiatric symptoms.

Relationships between memory specificity and measures of cognitive functioning

Associations between memory specificity (before and after treatment) and neuropsychological measures (before and after treatment) were assessed across all participants with Pearson correlation coefficients. No association between specificity and

neuropsychological functioning were assessed by group because the small number of participants and the large number of correlations to conduct.

Before treatment, there is significant correlation between the total numbers of generated specific events, the numbers of specific AM, and the numbers of future events with the scores of Digit Span Forward ($r(27) = .46, p = .016$; $r(27) = 0.38, p = .046$ and $r(27) = 0.39, p = .045$, respectively). No other significant correlation emerged.

After treatment, there is significant correlation between the total numbers of generated specific events, the numbers of specific AM with the scores of Digit Span Forward ($r(27) = .43, p = .026$; $r(27) = 0.42, p = .031$, respectively). Further, significant correlation emerged between the total number of generated specific events and the number of specific AM with the score of Verbal Fluency Task ($r(27) = 0.52, p = .006$ and $r(27) = 0.57, p = .002$, respectively).

According to these analyses, there is a stable relationship between executive functions measured by the Digit Span Forward order and the capacity to generate specific events. No difference as a function of time emerged for the Digit Span Forward. As the AM group performed higher than the control group on this test, a mixed design 2 (group) \times 2 (time) \times 2 (task) ANCOVA was conducted on the score of specificity with the scores of Digit Span Forward as covariate. For this analysis, a Digit Span Forward score corresponding to the mean of the Digit Span Forward scores before and after treatment was computed. Concerning the effects of the AM intervention, the results led to the same conclusion. Indeed, the Group \times Time interaction remained significant, $F(1,24) = 4.82, p = .038, \eta^2 = .168$. However, the main effects of group and time have disappeared.

Relationships between memory specificity and the intensity of affective symptoms

Associations between memory specificity (before and after treatment) and the intensity of affective symptoms (before and after treatment) were assessed across all participants with Pearson correlation coefficients. No significant correlation emerged.

Three months follow-up

Ten subjects from both psychiatry hospitals participated in the follow-up study. Table 4 summarizes demographic, clinical and neuropsychological characteristics of the population.

The ten word cues employed in the tasks of past and future events before treatment were employed as word cues in the task for past and future events for the follow-up study.

Insert Table 4 about here

Autobiographical memory specificity

A mixed design 2(time) x 2 (task) ANOVA was conducted on the number of generated specific events. Means for this analysis are shown in Table 5. The analysis revealed a significant main effect of time ($F(2,18) = 14.92, p <.001, \eta^2 = 0.62$). No significant main effect of task emerged. Post-hoc analyses revealed that participants have generated more specific events after treatment and three months after treatment than before treatment ($t(9) = 5.10, p <.001, \eta^2 = 0.178$, and $t(9) = 3.58, p =.006, \eta^2 = 0.123$, respectively) while no significant difference emerged between after treatment and three months after ($t(9) = 1.80, \text{ns}$).

Insert Table 5 about here

Discussion

The present results support the notion that, in schizophrenia patients, the capacities to generate past and future specific events can be improved by a cognitive intervention. The AM intervention is effective for alleviating the targeted cognitive impairments because it enhances cognitive functioning contrary to a non-specific intervention. Further, the significant results have emerged despite a small sample size; it also seems to elicit durable changes.

It is important to note that participants recalled different events than those reported in their diaries. The cognitive improvements after treatment are not the result from an overtraining. To the contrary, the findings suggest that the intervention effected upon the general capacity of schizophrenia patients to deliberately and intentionally recall specific personal events. Moreover, there is a difference between the remembering exercises imposed

by AM test and the remembering exercises completed by the participants during sessions with the dairies. Indeed, in the AM test participants were required to generate specific personal events without any information on the contextual characteristics (indices) such as time and place. These indices usually facilitate the recollection of a specific event. During the exercises with the diaries, participants were required to retrieve a specific personal event in response to, at least, one contextual characteristic which should facilitate the recollection of the event. Further, the target event was previously written in the diary. This task should consolidate the memory and facilitate the recollection. Thus, participants were trained with an easier memory task than the one employed for the evaluations.

However, the specific underlying cognitive mechanisms responsible for the changes are not identified in the present study. This clinical trial shows that a series of memory remediation exercises combined with exercises on self definition in a group setting may enhance the capacity of schizophrenia patients to generate specific events. We suggest that the AM intervention had taught patients to bind different aspects of events making the generation of specific events more efficient, and that the consolidation of the self facilitates the access to autobiographical material. Further, we can speculate that the psychoeducation about the impaired cognitive processes focuses participant's attention on the importance of personal goals and desires in life and motivates them to maintain some coherent and enduring goals.

The results suggest that the AM intervention may improve the executive functions. Indeed, the AM group tends to perform higher on the Stroop Test after treatment. However, this result has to be interpreted cautiously. The Group by Time interaction emerged significant also because the control group performances decreased. Further, no improvement on the other executive function evaluations was observed. In the same way, the results did not reveal an improvement on affective symptoms. Therefore, the present study does not offer evidence that this intervention generates improvements in the cognitive and affective aspects of the illness other than its AM impairments. Further, effect sizes of AM are modest. However, it is important to note that participants received only 10 weekly 1h30 group

sessions. A recent meta-analysis on the effectiveness of the well-known IPT program from Brenner, revealed that the mean treatment period is 17.2 weeks or 49.3 hours and mean frequency is 3.2 sessions a week [37]. Thus, one can expect that a therapeutic program containing more sessions with larger series of memory exercises may produce higher improvements with consequences on the other aspects of the disease such as neurocognition, psychopathology, and social functioning, like the IPT program from Brenner. As previous research shows that memory impairments are related to inadequate functional outcome [38] one can expect, more specifically, an improvement of the patients functioning in their daily life.

Contrary to previous research with schizophrenia patients [10], significant correlations between AM specificity and the Digit Span forward order test emerged. The correlation was found significant before and after intervention. After intervention significant correlations between AM specificity and the Verbal fluency test also emerged while it was not significant before the intervention. The discrepancies between previous results and those from the present study may be due to the heterogeneity of the schizophrenia population. However, it is interesting to note that when the Digit Span score is entered as covariate in the analysis, the main effect of group disappeared. This result underlines the crucial role of the working memory on the capacities to generate specific events. These findings suggest that before following an AM intervention schizophrenia patients should benefit from a CRT program focusing on the working memory remediation.

No association between the severity of the psychopathology before treatment and the specificity of AM was found. These results are in line with the results of previous research [10]. The relationship between the severity of the psychopathology and cognitive dysfunction in schizophrenia seems to depend upon the type of symptoms. Generally, performance on standard neuropsychological test is not strongly correlated with the severity of psychotic symptoms [39]. In contrast, the negative symptoms were associated more consistently with a poor cognitive functioning and, there is evidence that performance on executive functions tests is related to some aspects of everyday functioning [38, 40]. In the same way, CRT seems

to have little impact on symptoms [41, 42] while improvement in social functioning is reported [42, 43, 44]. Given the emphasis on self-regulation, goal-directed behavior in the model of AM provided by Conway and Pleydell-Pearse, it is difficult to imagine that improvement of AM would not impact patients' everyday functioning.

In schizophrenia disorder, the onset of the disease occurs in early adulthood (or late adolescence), that is during period in which the self start to play an essential rule in the organization of the individual's life. Consequently, if the AM intervention efficacy is confirmed by the future research, it would be particularly appropriate to propose this type of cognitive intervention to young individuals in early schizophrenia, that is after the first episode or after the emergence of the first psychotic symptoms, and particularly to the first degree relatives of schizophrenia patients who are not yet develop the disease. We can expect that the consolidation of the autobiographical material that constitutes the self could help to prevent the development of the schizophrenia disorder or to reduce the handicap.

Finally, future studies should evaluate the subjective experience associated with the recall of the memories. Indeed, it is plausible that, besides an increase in memory specificity, the present intervention has also improved autonoetic awareness' abilities in the AM group (that was not assessed in the present study). However, one cannot verify this assumption because autonoetic awareness was not assessed. Moreover, construction of self, symptom reduction, better social functioning and reduced relapse of such therapeutic intervention remain to be demonstrated. Nevertheless, the objective of this preliminary study was to determine whether specific AM could be improved in patients with schizophrenia. The results revealed that it is the case and suggests that AM remediation could be a useful additional intervention for schizophrenia patients.

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Table 1
Demographic and clinical characteristics of the samples; mean (SD)

Characteristics	AM intervention	Control intervention
Age (years)	41.2 (11.38)	37.25 (12.41)
Sex (M/F)	8/7	4/8
Education level (n)		
Primary school	1	0
Secondary school	7	4
College	3	7
Superior (no university)	2	1
Superior (university)	2	0
GAF score (1-90)	48.06 (6.40)	51.75 (6.96)
BPRS total score (18-126)	48.06 (8.55)	43.83 (12.96)
Illness duration (years)	15.40 (12.74)	12.00 (6.82)
Medication: CPZ equivalents ¹	502.53 (158.95)	406.25 (149.20)
Neuropsychological evaluation		
Verbal Fluency Task	16.15 (4.78)	13.94 (4.33)
Stroop-Color Word Test	103.46 (41.23)	82.25 (36.91)
Digit Span Forwards	5.86 (0.99)	4.83 (1.08)
Digit Span Backwards	4.06 (1.22)	3.25 (0.75)

Note. Between-group comparisons were conducted using T- tests for age, GAF, BPRS scores, illness duration, medication, and the neuropsychological evaluation. U Mann-Whitney tests were for sex and education levels comparisons.

¹Chlormoprazine equivalent dosages [30]

Table 2

TeMA scores for past and future events: Means (SD) for the number of generated specific events, before and after the interventions.

Intervention	Past events	Future events	Total
AM			
Before treatment	4.93 (2.28)	4.53 (1.99)	4.73 (1.82)
After treatment	6.93 (2.60)	7.06 (1.94)	7.00 (2.04)
Across treatment	5.93 (2.06)	5.83 (1.80)	5.86 (1.82)
Control			
Before treatment	3.92 (2.02)	3.66 (1.92)	3.79 (1.61)
After treatment	4.41 (1.97)	5.08 (2.37)	4.75 (1.68)
Across treatment	4.16 (1.81)	4.37 (1.46)	4.27 (1.40)

Table 3

Results from the neuropsychological and affective evaluations: Means (SD) in function of time and intervention.

Evaluations	AM intervention	Control intervention
Verbal fluency task		
Before treatment	16.15 (4.78)	13.94 (4.33)
After treatment	15.91 (3.82)	14.33 (3.66)
Across treatment	16.03 (4.05)	14.14 (3.82)
Stroop color word test		
Before treatment	103.46 (41.23)	82.25 (36.91)
After treatment	88.60 (41.35)	90.58 (34.29)
Across treatment	96.03 (38.93)	86.41 (34.12)
Digit span forward		
Before treatment	5.86 (0.99)	4.83 (1.08)
After treatment	5.93 (1.03)	5.33 (0.98)
Across treatment	5.90 (0.92)	5.08 (0.92)
Digit span backward		
Before treatment	4.06 (1.22)	3.25 (0.75)
After treatment	4.26 (1.38)	3.50 (0.90)
Across treatment	4.16 (1.23)	3.37 (0.68)
BDI		
Before treatment	14.80 (10.62)	18.00 (4.94)
After treatment	14.20 (9.58)	19.20 (7.05)
Across treatment	14.50 (8.57)	18.60 (5.29)
STAI Y-A form		
Before treatment	42.28 (17.04)	47.58 (12.65)
After treatment	42.85 (10.92)	42.91 (9.57)
Across treatment	42.57 (12.13)	45.25 (9.94)

Table 4

Demographic and clinical characteristics of the sample for the follow-up study; mean (SD)

AM intervention	
Age (years)	42.3 (11.34)
Sex (M/F)	5/5
Education level (n)	
Primary school	1
Secondary school	5
College	1
Superior (no university)	2
Superior (university)	1
GAF score (1-90)	49.10 (5.50)
BPRS total score	49.60 (8.39)
Illness duration	17.00 (13.40)
Medication: CPZ equivalents ¹	508.00 (185.10)
Neuropsychological evaluation	
Verbal Fluency Task	16.73 (4.85)
Stroop-Color Word Test	118.60 (41.26)
Digit Span Forwards	5.50 (0.70)
Digit Span Backwards	3.80 (0.78)

Note. ¹Chlormoprazine equivalent dosages [30].

Table 5

Results from the follow-up: Means and standard deviations for the number of generated specific events in function of task and time.

AM intervention	Past events	Future events	Total
Before treatment	5.10 (1.91)	4.30 (2.31)	4.70 (1.82)
After treatment	6.90 (2.29)	7.30 (1.63)	7.10 (2.11)
3 months after	7.10 (1.66)	5.60 (2.45)	6.35 (1.97)