Improvements in Autobiographical Memory in Schizophrenia Patients after a Cognitive Intervention

A Preliminary Study

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Key Words
Schizophrenia · Autobiographical memory · Self-identity · Cognitive intervention

Abstract

Background: Schizophrenia is associated with a reduction in accessing specific autobiographical information. This is consistent with the abnormal development of personal identity that characterizes this mental disorder. Using a schizophrenic population, the present study evaluates the effect of a cognitive intervention on autobiographical memory and the capacity to project oneself in the future. Sampling and Method: The intervention consisted of group sessions, during which participants were trained to recollect specific events reported in their diary. Furthermore, exercises to stimulate their thoughts about their personal identity were proposed. An autobiographical memory test was administered before the intervention, after the intervention and at the 3-month follow-up. In addition, neuropsychological and affective assessments were conducted before and after treatments. Patients’ performances were compared to those from the control group. Results: The ability to recall specific events was improved by the cognitive intervention, and the benefits were preserved 3 months later. However, no neuropsychological or affective benefit was found. Conclusion: Despite positive results on specific memory, any significant benefits have yet to be extended to other clinical variables such as symptom reduction and neuropsychological/social functioning. Nevertheless, the results revealed that cognitive remediation therapy could be a useful additional intervention for autobiographical memory deficits in schizophrenia patients.

Introduction

The present clinical trial was inspired by the theoretical model of schizophrenia presented by Huron and Danion [1] and Danion et al. [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 in autonoetic awareness, which 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 cognitive remediation therapy (CRT) combined with the principles of cognitive
behavioural therapy (CBT) in a group setting. To provide the theoretical foundation of the present intervention, the model of schizophrenia proposed by Huron and Danion [1] and Danion et al. [2] and supportive evidence are presented.

Schizophrenia is accompanied by disturbances in AM. These disturbances can take the form of an overgeneral retrieval style; individuals with schizophrenia instructed to recall a specific event distinctly located in time and space (e.g. ‘my best friend’s visit to my home 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 et al. [4], comparing autobiographical memories of 19 schizophrenia patients to those of 10 controls, reported deficits in both personal episodic memories (events) and semantic memories (facts) in schizophrenia patients. Their recall was poorest for the early adulthood 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 deficits in specific AM in schizophrenia patients has been largely reported across the different types of schizophrenia [5–10]. Furthermore, based on evidence that AM retrieval and thinking of the future share common processes [11, 12], Neumann [unpublished doctoral thesis] 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 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 that characterizes autonoetic awareness leads 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 episodic or autobiographical memory tasks should also 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 et al. [18], the impairment in autonoetic awareness in schizophrenia results from a failure in 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. Furthermore, 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 recall in an intentional and strategic way is impaired in schizophrenia patients [18–20], and that the recall is accompanied by a low level of autonoetic awareness [10, 18, 21]. The impairment in autonoetic awareness in schizophrenia could play a fundamental role in the development and 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 travelling in time, allowing the individual to mentally go back into 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 and 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. Thus, one function of AM is to construct the self. The idea that there is a fundamental disruption in the sense

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Psychopathology 2008;41:388–396
of self-identity and/or poor self-identity in schizophrenia is largely put forward by theoretical models [2, 22–24], and empirical studies support this idea [25–27].

In summary, the theoretical model used postulates that specific AM, autonoetic awareness and the construction of self are related, and that schizophrenia is a mental disorder characterized by impairments on these 3 levels [1, 2]. These forms of cognitive impairments seem to be a core problem in schizophrenia. However, to our knowledge, no intervention for these cognitive deficits has been proposed to date. The purpose of the present study was to test a therapeutic intervention efficacy to enhance the abilities of schizophrenia patients to generate specific personal memories. Specifically, the goals were: (1) to investigate AM, as well as the ability to project oneself in the future, in patients with schizophrenia, and (2) to evaluate the programme’s 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 degree of self-relevance of the event. They performed repeated exercises in remembering events reported in the diary, and their reflection 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 psycho-education about the disease or conversation training.

### Table 1. Demographic and clinical characteristics of the samples

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>AM intervention</th>
<th>Control intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>41.2 ± 11.38</td>
<td>37.25 ± 12.41</td>
</tr>
<tr>
<td>Males/females</td>
<td>8/7</td>
<td>4/8</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Secondary school</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>College</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Superior, no university</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Superior, university</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>GAF score (1–90)</td>
<td>48.06 ± 6.40</td>
<td>51.75 ± 6.96</td>
</tr>
<tr>
<td>BPRS total score (18–126)</td>
<td>48.06 ± 8.55</td>
<td>43.83 ± 12.96</td>
</tr>
<tr>
<td>Illness duration, years</td>
<td>15.40 ± 12.74</td>
<td>12.00 ± 6.82</td>
</tr>
<tr>
<td>Medication1</td>
<td>502.53 ± 158.95</td>
<td>406.25 ± 149.20</td>
</tr>
<tr>
<td>Neuropsychological evaluation, scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Fluency Task</td>
<td>16.15 ± 4.78</td>
<td>13.94 ± 4.33</td>
</tr>
<tr>
<td>Stroop Color-Word Test</td>
<td>103.46 ± 41.23</td>
<td>82.25 ± 36.91</td>
</tr>
<tr>
<td>Digit Span forwards</td>
<td>5.86 ± 0.99</td>
<td>4.83 ± 1.08</td>
</tr>
<tr>
<td>Digit Span backwards</td>
<td>4.06 ± 1.22</td>
<td>3.25 ± 0.75</td>
</tr>
</tbody>
</table>

Results presented as means ± SD, where indicated. Between-group comparisons were conducted using t tests for age, Global Assessment of Functioning Scale (GAF) and Brief Psychiatric Rating Scale (BPRS) scores, illness duration, medication and the neuropsychological evaluation. Mann-Whitney U tests were used for sex and education level comparisons.

1 Chlormoprazine equivalent dosages [30].

**Method**

**Participants**

Fifteen patients completed the AM intervention while 12 completed the control intervention; in each group, 3 patients dropped out after 1 or 2 sessions. The clinical interventions were conducted in 2 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 2 psychiatrists, and they had been clinically stabilized for several months. They were medicated by either typical or atypical antipsychotic drugs, antiparkinsonian drugs, antidepressant drugs and benzodiazepines. Exclusion criteria were: (1) current problems 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 2 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 differences between the 2 groups emerged regarding the demographic and clinical characteristics.

**Dependent Measures**

**Autobiographical Memory Test**

**Task for Past Events**

A validated French version [Neumann and Philippot, unpublished manuscript] of the Autobiographical Memory Test (AMT) [3] 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 [31]. Ten cue words, 5 positive and 5 negative were presented to participants. For each word cue, participants had 1 min 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 by Williams and collaborators [3] 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. It was explained to participants 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, 5 positive and 5 negative. For this version, participants were asked ‘Can you report a future personal event that the word … evokes?’.

The 10 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 tasks, in order to familiarize the participants with the procedure, they were asked to complete 2 practice 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 Function Measures

A neuropsychological test battery was applied before and after treatments to assess the participants’ 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 administered 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 2 participants in the control group. The Y-Ä 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 1 participant in the AM group. Participants completed these questionnaires before and after treatment.

Content of the Interventions

The clinical interventions consisted of 10 weekly 90-min group sessions, conducted by 2 therapists. In both hospitals, 1 of the 2 therapists was a certified CBT therapist.

Autobiographical Memory Intervention

The therapists were trained by the 2 first authors. During sessions, the therapists’ interventions aimed to draw out participants’ 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 impairments in memory, each participant was asked to recall what he or she had done the previous Wednesday with as much detail 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, 1 practice trial was proposed. All participants were asked to report a personal event that had occurred the day before and to describe the event 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. Thus, participants were 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. The next session started after they had discussed the contents of their diaries.

Fourth Session. As in the previous session, diaries were exchanged and questions were asked. Additionally, diaries from the previous session were distributed, and participants were invited to question their partner. All the following sessions started with these memory exercises. Then, the session continued with a discussion on personal identity. Motivation and the participants’ notion of personal identity and its relationship to motivation. An exercise on self-definition was proposed [M. Conway, pers. commun., 17/02/2004]. Participants were asked to report 3 self-defining adjectives. In order to stimulate the self-definition of personal events, participants had to recall a specific personal life event that was illustrated by 1 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 2 specific personal events illustrating each of the 2 remaining self-defining adjectives.

Fifth Session. After the memory 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 memory exercises, the session continued with a discussion on personal goals in life. Participants reflected 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 memory exercises, the session continued with a discussion on the steps needed to reach the goals. Each participant revealed to the others the steps they had taken. To motivate participants to take the requested steps, the therapists proposed an exercise. Participants were asked to vividly project 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 Sessions. After the memory exercise, the session continued with a discussion on personal goals.

Tenth Session. After the memory 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 events completed before intervention. During the following days, participants were asked to complete the task for future events with the series of words used during the AM test completed before intervention.

Control Intervention

Control patients took part in interventions targeting either psycho-education about schizophrenia or conversation training. These interventions consisted of 90-min group sessions, conducted by the same therapist experienced in CBT that 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 as 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) × 2 (time) × 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 = 0.02, η² = 0.198, and F(1, 25) = 30.86, p < 0.001, η² = 0.55, respectively]. Inspections of the means showed that the AM group was more specific than the control group, and that participants were more specific after the treatments than before the treatments [4.31 ± 1.76 (SD) and 6.00 ± 2.17, respectively]. These main effects were qualified by a significant group by time interaction [F(1, 25) = 5.08, p = 0.033, η² = 0.168]. In line with our hypothesis, post hoc analyses showed no significant differences between the groups before treatments, while participants in the AM group reported more specific autobiographical material than the control group after the clinical interventions [before treatment: t(25) = 1.40, ns; after treatment: t(25) = 3.06, p = 0.005, η² = 0.225]. No significant main effect or interaction involving task emerged.

For each patient, the content of the events reported after the tests was compared to the content of the events reported before the tests for past and future events, and was compared to the content of the events reported in the dairies. The comparisons showed that participants collected different personal events, excepted for 1 event by 1 participant for the AM test. Thus, the observed difference in scores cannot be accounted for by an improvement in memory for the events rehearsed during sessions.

**Executive Function Measures**

A mixed design 2 (group) × 2 (time) ANOVA was conducted on each neuropsychological measure. Means for these analyses are shown in [table 3](#).

### Table 2. AM scores for past and future events (means ± SD) for the number of generated specific events, before and after the interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Past events</th>
<th>Future events</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>4.93 ± 2.28</td>
<td>4.53 ± 1.99</td>
<td>4.73 ± 1.82</td>
</tr>
<tr>
<td>After treatment</td>
<td>6.93 ± 2.60</td>
<td>7.06 ± 1.94</td>
<td>7.00 ± 2.04</td>
</tr>
<tr>
<td>Across treatment</td>
<td>5.93 ± 2.06</td>
<td>5.83 ± 1.80</td>
<td>5.86 ± 1.82</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>3.92 ± 2.02</td>
<td>3.66 ± 1.92</td>
<td>3.79 ± 1.61</td>
</tr>
<tr>
<td>After treatment</td>
<td>4.41 ± 1.97</td>
<td>5.08 ± 2.37</td>
<td>4.75 ± 1.68</td>
</tr>
<tr>
<td>Across treatment</td>
<td>4.16 ± 1.81</td>
<td>4.37 ± 1.46</td>
<td>4.27 ± 1.40</td>
</tr>
</tbody>
</table>

### Table 3. Results from the neuropsychological and affective evaluations, presented as means ± SD, broken down over time and intervention

<table>
<thead>
<tr>
<th>Evaluations</th>
<th>AM intervention</th>
<th>Control intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal fluency task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>16.15 ± 4.78</td>
<td>13.94 ± 4.33</td>
</tr>
<tr>
<td>After treatment</td>
<td>15.91 ± 3.82</td>
<td>14.33 ± 3.66</td>
</tr>
<tr>
<td>Across treatment</td>
<td>16.03 ± 4.05</td>
<td>14.14 ± 3.82</td>
</tr>
<tr>
<td>Stroop Colour-Word Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>103.46 ± 41.23</td>
<td>82.25 ± 36.91</td>
</tr>
<tr>
<td>After treatment</td>
<td>88.60 ± 41.35</td>
<td>90.58 ± 34.29</td>
</tr>
<tr>
<td>Across treatment</td>
<td>96.03 ± 38.93</td>
<td>86.41 ± 34.12</td>
</tr>
<tr>
<td>Digit Span forward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>5.86 ± 0.99</td>
<td>4.83 ± 1.08</td>
</tr>
<tr>
<td>After treatment</td>
<td>5.93 ± 1.03</td>
<td>5.33 ± 0.98</td>
</tr>
<tr>
<td>Across treatment</td>
<td>5.90 ± 0.92</td>
<td>5.08 ± 0.92</td>
</tr>
<tr>
<td>Digit Span backward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>4.06 ± 1.22</td>
<td>3.25 ± 0.75</td>
</tr>
<tr>
<td>After treatment</td>
<td>4.26 ± 1.38</td>
<td>3.50 ± 0.90</td>
</tr>
<tr>
<td>Across treatment</td>
<td>4.16 ± 1.23</td>
<td>3.37 ± 0.68</td>
</tr>
<tr>
<td>Beck Depression Inventory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>14.80 ± 10.62</td>
<td>18.00 ± 4.94</td>
</tr>
<tr>
<td>After treatment</td>
<td>14.20 ± 9.58</td>
<td>19.20 ± 7.05</td>
</tr>
<tr>
<td>Across treatment</td>
<td>14.50 ± 8.57</td>
<td>18.60 ± 5.29</td>
</tr>
<tr>
<td>State-Trait Anxiety Inventory Y-A form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before treatment</td>
<td>42.28 ± 17.04</td>
<td>47.58 ± 12.65</td>
</tr>
<tr>
<td>After treatment</td>
<td>42.85 ± 10.92</td>
<td>42.91 ± 9.57</td>
</tr>
<tr>
<td>Across treatment</td>
<td>42.57 ± 12.13</td>
<td>45.25 ± 9.94</td>
</tr>
</tbody>
</table>
Fluency Task, no significant main effect or interaction emerged. For the Stroop Colour-Word Test, the analysis revealed a significant time by group interaction \[F(1, 25) = 5.88, p = 0.022\]. Inspection of means revealed that the AM group tended to perform 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 \[F(1, 25) = 5.16, p = 0.031\]. Inspection of the means showed that the AM group performed better than the control group.

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

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 treatment, after treatment and 3 months later) 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 associations between specificity and neuropsychological functioning were assessed by group, because of the small number of participants and the large number of correlations to conduct.

Before treatment, there was 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 \[r(27) = 0.46, p = 0.016; r(27) = 0.38, p = 0.046\] and \[r(27) = 0.39, p = 0.045\]. No other significant correlations emerged.

After treatment, there was significant correlation between the total numbers of generated specific events, the numbers of specific AM with the scores of Digit Span forward \[r(27) = 0.43, p = 0.026; r(27) = 0.42, p = 0.031\]. Furthermore, significant correlations emerged between the total number of generated specific events and the number of specific AM with the score of Verbal Fluency Task \[r(27) = 0.52, p = 0.006\] and \[r(27) = 0.57, p = 0.002\].

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 better than the control group on this test, a mixed design 2 (group) × 2 (time) × 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 us to the same conclusion, and the group × time interaction remained significant \[F(1, 24) = 4.82, p = 0.038, \eta^2 = 0.168\]. However, the main effects of group and time 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.

Three-Month 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 10 word cues employed in tasks of past and future events before treatment were employed as word cues in the tasks for past and future events for the follow-up study.

Autobiographical Memory Specificity
A mixed design 2 (time) × 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 \[F(2, 18) = 14.92, p < 0.001, \eta^2 = 0.62\]. No significant main effect of task emerged. Post hoc analyses revealed that participants generated more specific events after treatment and 3 months after treatment than before treatment \[t(9) = 5.10, p < 0.001, \eta^2 = 0.178\] and \[t(9) = 3.58, p = 0.006, \eta^2 = 0.123\].
respectively] while no significant difference emerged between after treatment and the 3-month follow-up \( [t(9) = 1.80, \text{ns}] \).

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 in alleviating the targeted cognitive impairments because it enhances cognitive functioning, unlike to a non-specific intervention. Furthermore, the significant results emerged despite a small sample size, and are long lasting.

It is important to note that participants recalled different events than those reported in their diaries. The cognitive improvements after treatment did not result from overtraining. On the contrary, the findings suggest that the intervention had an effect upon the general capacity of schizophrenia patients to deliberately and intentionally recall specific personal events. Moreover, there is a difference between the memory exercises imposes by the AM test and the memory exercises completed by the par-

| Table 4. Demographic and clinical characteristics of the sample for the follow-up study |
|---------------------------------|---------------------------------|
| Age, years                      | AM intervention                  |
| Male/female                     | 42.3 ± 11.34                    |
| Education level                 | 5/5                              |
| 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, years         | 17.00 ± 13.40                   |
| Medication1                     | 508.00 ± 185.10                 |
| Verbal Fluency Task             | 16.73 ± 4.85                    |
| Stroop Colour-Word Test         | 118.60 ± 41.26                  |
| Digit Span forwards             | 5.50 ± 0.70                     |
| Digit Span backwards            | 3.80 ± 0.78                     |

Data are presented as means ± SD, where indicated. GAF = Global Assessment of Functioning Scale; BPRS = Brief Psychiatric Rating Scale.

1 Chlormoprazine equivalent dosages.

Table 5. Results from the follow-up, presented as means ± SD for the number of generated specific events according to task and time

<table>
<thead>
<tr>
<th>AM intervention</th>
<th>Past events</th>
<th>Future events</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treatment</td>
<td>5.10 ± 1.91</td>
<td>4.30 ± 2.31</td>
<td>4.70 ± 1.82</td>
</tr>
<tr>
<td>After treatment</td>
<td>6.90 ± 2.29</td>
<td>7.30 ± 1.63</td>
<td>7.10 ± 2.11</td>
</tr>
<tr>
<td>3 months later</td>
<td>7.10 ± 1.66</td>
<td>5.60 ± 2.45</td>
<td>6.35 ± 1.97</td>
</tr>
</tbody>
</table>

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 1 contextual characteristic that should facilitate recollection of the event. Furthermore, 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.

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 taught patients to bind different aspects of events, making the generation of specific events more efficient, and that consolidation of the self facilitates the access to autobiographical material. Furthermore, we can speculate that the psycho-education about the impaired cognitive processes focuses participants’ attention on the importance of personal goals and desires in life and motives them to maintain some coherent and enduring goals.

The results suggest that the AM intervention may improve executive functions. Indeed, the AM group tended to perform better on the Stroop Test after treatment. However, this result has to be interpreted cautiously. The group by time interaction was significant also because the control group performances decreased. In addition, no improvement in the other executive function evaluations was observed. In the same way, the results did not reveal an improvement in affective symptoms. Therefore, the present study does not offer evidence that this inter-
vention generates improvements in the cognitive and affective aspects of the illness, other than its AM impairments. Furthermore, the effect sizes of AM are modest. However, it is important to note that participants received only 10 weekly 90-min sessions. A recent meta-analysis on the effectiveness of the well-known Integrated Psychological Therapy (IPT) programme from Brenner and colleagues [37], revealed that the mean treatment period is 17.2 weeks or 49.3 h and the mean frequency is 3.2 sessions per week. Thus, one can expect that a therapeutic program containing more sessions with larger series of memory exercises may produce stronger improvements, with consequences on the other aspects of the disease such as neurocognition, psychopathology and social functioning, like the IPT program from Brenner and colleagues [37]. As previous research shows that memory impairments are related to inadequate functional outcome [38], one can expect, more specifically, an improvement in the patients functioning during daily life.

Contrary to previous research with schizophrenia patients [10], significant correlations between AM specificity and the Digit Span forward test emerged. The correlation was found to be significant before and after intervention. After intervention, a significant correlation between AM specificity and the Verbal Fluency Test also emerged, which 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 ability to generate specific events. These findings suggest that before following an AM intervention, schizophrenia patients should benefit from a CRT program focusing on 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 a standard neuropsychological test is not strongly correlated with the severity of psychotic symptoms [39]. In contrast, the negative symptoms were associated more consistently with poor cognitive functioning, and there is evidence that performance on executive function 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 improvements in social functioning are reported [42–44]. Given the emphasis on self-regulation and goal-directed behavior in the model of AM provided by Conway and Pleydell-Pearse [13], it is difficult to imagine that improvements in AM would not have an impact on patients’ everyday functioning.

In schizophrenia, the onset of the disease occurs in early adulthood (or late adolescence), which is during the period where the self starts to play an essential role 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 have not yet developed the disease. We can expect that the consolidation of the autobiographical material that constitutes the self could help to prevent the development of schizophrenia or to reduce the handicap.

Finally, future studies should evaluate the subjective experience associated with recalling memories. Indeed, it is plausible that, besides an increase in memory specificity, the present intervention has also improved autonoetic awareness in the AM group. 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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