Clinical features of latent inhibition in schizophrenia


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Abstract

Paradigms of Latent Inhibition (LI) are inter-species and derived from learning theories. They are considered as tools which allow the attentional processes to be studied. The absence of LI is interpreted as difficulty in discriminating relevant and irrelevant stimuli. Abolition of LI has been shown in acute schizophrenics. The objectives of our study were partly to validate an LI paradigm, based on a contingency detection between two stimuli, in healthy subjects, and partly to analyse LI in schizophrenics. The study included 105 subjects (65 patients and 40 controls). Patients fulfilled the DSM IV diagnosis of schizophrenia. 35 in the acute phase and 30 in the chronic phase. We observed a loss of LI for acute schizophrenics, and an enhancement of LI for chronic schizophrenics. The variations in LI are interpreted from the perspective of a disturbance in the attentional processes. The LI status in acute schizophrenics appears to correlate with the clinical criteria with a prognostic value (low intensity of the negative dimension, late age at the first hospitalization). Moreover, the enhancement of LI correlates with the negative dimension of schizophrenic disease. This correlation is found in acute and chronic schizophrenics. It suggests that the variations of LI may be an indicator of adaptive strategies to a cognitive dysfunction specific to schizophrenia. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Inter-species character; Latent inhibition; Schizophrenia

1. Introduction

Paradigms of Latent Inhibition (LI) are derived from learning theories. The inter-species character of this phenomenon has been demonstrated (Lubow, 1989; Gray et al., 1991). They are considered as tools which allow the attentional processes to be studied in animals (Lubow et al., 1982). Animal studies have shown the abolition of LI following the administration of indirect dopaminergic agonists, like amphetamines (Weiner et al., 1988). This phenomenon was restored by blocking the dopaminergic receptors with neuroleptics (Solomon et al., 1981). When neuroleptics are administered by themselves, they enhance LI (Christison et al., 1988; Feldon and Weiner, 1991). In man, the LI phenomenon has been demonstrated, as has its modification with dopaminergic substances (Gray et al., 1992b).

All of these data have led to the hypothesis being made, that a disturbance of the LI phenomenon exists in schizophrenia (Lubow et al., 1987; Lubow and Gewirtz, 1995). LI paradigms are useful for examination of the cognitive alterations seen in schizophrenia (Gray et al., 1991; Hemsley, 1993; Hemsley1996; Vaitl and Lipp, 1997). The absence of LI is interpreted as difficulty in discriminating relevant and irrelevant stimuli (Hemsley, 1996). Abolition of LI has been shown in patients in the acute phase (Baruch et al.,

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1988a), which leads one to suspect there to be a relationship between a hyperdopaminergic state and the abolition of LI. According to Gray et al. (1992a) the loss of LI is associated not with positive symptoms but with the acute stage of the illness. Later studies are controversial. They do not show any difference in performance between chronic and acute schizophrenics (Swerdlow et al., 1996) or they attribute normalization of LI to the neuroleptic treatment (Williams et al., 1998). These controversies are probably a reflection of a heterogeneous distribution of LI in schizophrenic patients. The clinical and therapeutic characteristics and stage of disease (acute or chronic) of schizophrenic patients, who have this type of abnormality, deserve attention. The objectives of our study were partly to validate an LI paradigm inspired by Ginton et al. (1975), in healthy subjects, and partly to study and analyse the LI phenomenon in schizophrenics, respecting the methodological restrictions followed in Gray and Baruch’s studies.

2. Method

2.1. Patients

The study included 105 subjects (65 patients and 40 controls). The 65 patients were hospitalized either full-time or part-time in the Lille University Psychiatric Department. They fulfilled the DSM IV diagnosis of schizophrenia, using the French version of MINI (Minimum International Neuropsychiatric Interview) (Lecrubier et al., 1998). The patients were split into two groups: (i) a group of patients in the acute phase, who were hospitalized and tested in the first 15 days following the start of their psychotic episode; (ii) a group of chronic schizophrenic patients, who were tested more than 15 days following the start of their acute psychotic episode, using the same method as the one proposed by Baruch (1988). The clinical subtypes were defined according to the DSM IV criteria. The general psychiatric symptomatology was evaluated with the Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962) and the total score of the Positive and Negative Symptoms Scale (PANSS) (Kay et al., 1987). The positive and negative symptomatology was evaluated with the PANSS subscales. The age of the patients at the time of their first hospitalization, the duration of their illness since the first hospitalization, length of evolution under treatment and the length of time since the last acute psychiatric episode, were noted. Concomitant treatment with benzodiazepines and antiparkinsonian drugs were allowed. The patients with organic brain disease, addictive behaviour (alcohol or other substances), and uncorrected visual or hearing disorders were excluded.

2.2. Controls

The 40 controls were recruited from blood donors attending the Lille Regional Blood Transfusion Centre. Mini-Mult (1988) was performed for each control, which allowed any individuals with a marked schizotypic tendency to be excluded (Baruch et al., 1988b; Lipp and Vaitl, 1992; Lubow et al., 1992; De La Casa et al., 1993). The control group did not have any history of current organic brain disease, psychiatric disorder or addictive behaviour. They did not take any treatment.

All the subjects reached the inclusion criteria. All of the subjects who participated in the study gave their written informed consent, after being informed about the nature and the objectives of the study.

3. Test

3.1. Principle

The test is a contingency detection paradigm inspired from Ginton (1975) and Baruch (1988). It took place in two stages (the mask task and the LI test) for the two groups of patients (preexposed PRE, non-preexposed NPE). The PRE group started with a “mask task”, during which they were preexposed to an irrelevant stimulus (a square), which they had to implicitly learn to ignore. Later on, the LI test began. This stimulus became a relevant stimulus (CS: conditional stimulus), which predicted a sound being produced (US: unconditional stimulus). The NPE group started by performing a “mask task” without preexposure to the square. During the LI test, the square predicting production of the sound, was presented to them for the first time.
3.2. Procedure

The experiment took place in a quiet (background sound = 15 dBA), well-lit, spacious room. The subject was seated at a table, 70 cm from a monitor. The investigator was to the right of the subject, set back and out of his visual field. The test took place on an IBM-compatible, Kenitec (R) NPB (486 SX 25) laptop computer. The screen was $21 \times 15.5$ cm$^2$.

3.2.1. First phase: the mask task (Figs. (1) and (2))

A list of 30 trigrams without any semantic order, formed of 3 letters, $1.1 \times 1.1$ cm$^2$ in size (TOG, PEC, ...
GAC, ...) were shown on a white square (6.5 x 6.5 cm²) in the centre of the screen, with a black background. The trigrams were repeated five times in a pseudorandom order for 80 ms, from a list of 150 trigrams. This phase lasted 4 min. The subject was asked to count the number of TOGs and PECs, and to say how many were there at the end of the test. At the start of the test, the experimenter said to the subject: “the test which you are doing will be in two parts. Firstly, on the computer screen, a list of trigrams will be shown. I would like you to count how many times you see TOG (called T-O-G) and PEC (called P-E-C). At the end of the test, I will ask you how many times you saw TOG and PEC. Then I will explain the second part of the test to you”. The results of this task made sure that the subject was capable of performing the task. The subjects with a score of less than 4 or greater than 6 did not fulfill the conditions for success in this task.

3.2.2. Second phase: examination of the phenomenon of latent inhibition (Fig. 3)

The same list of 150 trigrams with 30 squares was shown on the screen. Each square was always followed by a 50 Hz 80 dBA sound lasting 200 ms, which was made by the computer. A second set of instructions were given to the subjects who had performed the mask task, irrespective of which procedure had been used (with or without preexposure): “On the computer screen, you will see trigrams appear, but in addition, you will hear a sound several times during the test. I would like you to look at the screen, and to lift up your hand when you think that the computer is going to make a sound.” The response was valid when the subject responded correctly three times in succession, which showed that he had understood the rule governing the appearance of the sound. A delayed response of more than 4 “square-sound” sequences was the criterion for LI. The number of “square-sound” sequences shown before the subject’s response, allowed the intensity of the LI phenomenon to be measured. The score was equal to “30-(number of times the “square-sound” sequence was shown)”. The subjects with LI showed scores between 25 to 0. The subjects, without IL, learning faster the association “square-sound”, elicited scores between 30 and 26.

The consecutive subjects were randomized, by means of a random number table, into the preexposed and non-preexposed groups.
Table 1
Characteristics of the subjects

<table>
<thead>
<tr>
<th>Group</th>
<th>Sex</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>Acute patients</td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>(N = 35)</td>
<td></td>
<td></td>
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<tr>
<td>Chronic patients</td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td>(N = 30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal subjects</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>(N = 40)</td>
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</table>
Table 2
Clinical characteristics of schizophrenic patients

<table>
<thead>
<tr>
<th></th>
<th>Acute patients</th>
<th>Chronic patients</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANSS</td>
<td>82.10 ± 14.34</td>
<td>70.93 ± 15.36</td>
<td>2.93</td>
<td>0.005</td>
</tr>
<tr>
<td>Positive scale</td>
<td>17.29 ± 5.23</td>
<td>13.23 ± 4.22</td>
<td>3.33</td>
<td>0.002</td>
</tr>
<tr>
<td>Negative scale</td>
<td>23.94 ± 6.76</td>
<td>22.10 ± 7.50</td>
<td>1.005</td>
<td>ns</td>
</tr>
<tr>
<td>General scale</td>
<td>40.58 ± 8.68</td>
<td>35.50 ± 7.74</td>
<td>2.4</td>
<td>0.02</td>
</tr>
<tr>
<td>BPRS</td>
<td>47.77 ± 11.34</td>
<td>39 ± 8.61</td>
<td>3.47</td>
<td>0.001</td>
</tr>
</tbody>
</table>

4. Statistical analysis

A descriptive, comparative analysis about the clinical characteristics from the three groups: control, acute and chronic schizophrenics, was made using the chi-square test and the Student’s t-test. The main discriminating criterion was the presence of LI with a score of less than 26, or the absence of LI with a score of greater than or equal to 26. The intensity of the phenomenon of LI was evaluated by the number of “square-sound” sequences which were shown to the subject, before a response was obtained (26 > score > 0). The validity of the LI test was tested in preexposed and non-preexposed control groups, by calculation of the sensitivity and the specificity. The hypothesis of a different performance for the test, depending on the diagnosis (control group and schizophrenics) and preexposed/non-preexposed condition was tested using a rank variance analysis method (Conover et al, 1982). Comparison of the mean scores and the characteristics of the subjects according to the LI criterion, were made using Mann–Whitney’s U-test. The correlation between the LI scores and the characteristics of the subjects were evaluated using Spearman’s test.

![Median scores +/- Sd](image)

Fig. 4. Median responses.
5. Results

The characteristics of the subjects are shown in Table 1. The characteristics of the acute and chronic schizophrenics are in Table 2.

The 65 patients who fulfilled the DSM IV diagnostic criteria for schizophrenia, were divided into two groups: 35 patients in the acute phase (paranoid: \( n = 11 \), disorganized: \( n = 5 \), undifferentiated: \( n = 19 \)). Six of them were free from neuroleptic treatment and 12 of them had been hospitalized for the first time.

Thirty patients were in the chronic phase (mean time since the hospitalization for the last acute psychotic episode = 62.76 weeks, SD = 122.74) (paranoid: \( n = 6 \), disorganized: \( n = 12 \), undifferentiated: \( n = 12 \)). 2 patients were not receiving neuroleptics treatment.

There was no significant difference between the groups for their sociodemographic criteria, apart from the sex ratio. See Table 1.

The results of the test are shown in Fig. 4. The median response to the test is shown for each group in Figs. 5–7.

5.1. LI criterion

Preexposure produced a learning delay in 80% of the controls. Five subjects did not find the association. The sensitivity of the test for the control group was 80%, its specificity was 100%. These characteristics validate the test for studying the phenomenon of LI.

The ANOVA test “diagnostic group × condition” showed an effect for the condition \((F(1.103) = 28.22, p < 0.001)\) and an effect for the group \((F(2.102) = 5.22, p = 0.007)\). The group × condition interaction was significant \((F(4.101) = 3.08, p = 0.05)\). The condition effect was explained by a significant delay caused by preexposure in all of the groups: (median score PRE vs NPE = 20 vs 27; \( U = 662, p < 0.001 \)).

Post Hoc analysis of all of the scores (preexposed and non-preexposed) showed that the group effect could be explained by a significantly slower learning
in the chronic schizophrenic patients (median score = 20) than in the acute schizophrenics or the controls ($F(2,102) = 3.5, p = 0.03$). The acute schizophrenics were no different from the controls (median score = 27).

The group $\times$ condition interaction was explained by a difference in the sensitivity to preexposure for the patients in the acute phase on the one hand, and the patients in the chronic phase and the controls on the other hand. In fact, the preexposed chronic schizophrenics were slower in finding the association than the non-preexposed chronic schizophrenics (median score = 0 vs 25) ($U = 42.5, p = 0.003$). It was the same for the controls (median score = 22 vs 29) ($U = 31, p < 0.001$). However, for the acute schizophrenics, there was no statistical difference between the scores of the preexposed and the non-preexposed patients (median score = 27) ($U = 120.5, NS$). The scores of the non-preexposed acute schizophrenics (median = 27, SD = 10.42) and the non-preexposed chronic schizophrenics (median = 25, SD = 9.53) were not statistically different ($U = 92.5, NS$). On the other hand, the preexposed acute schizophrenics (median = 27, SD = 12) were more rapid ($U = 87, p = 0.03$) than the preexposed chronic schizophrenics (median = 0, SD = 11.36). In the preexposed condition, there was a trend towards superior acute schizophrenic performance relative to normals (median score = 27 vs 22). The preexposed acute schizophrenics were not significantly more rapid than the preexposed controls ($U = 171, NS$). The preexposed chronic schizophrenic group was slower than the preexposed controls (median = 22, SD = 11.31). This difference is close to being significant ($U = 104.5, p = 0.08$). The effect of preexposure is therefore significantly different between patients in the acute phase than patients in the chronic phase.

These results note a phenomenon of LI in the control group as well as in the group of schizophrenics in the chronic phase. In the group of patients in the acute phase, the phenomenon of LI was not observed.

In the NPE schizophrenic patients both in the acute or chronic phases, 15% of the subjects did not find the association. In chronic schizophrenic patients, preexposure caused a significant delay and a larger
proportion (50%) of patients who did not find the association.

In the preexposed acute schizophrenics, a bimodal distribution of the responses was observed. 50% of them responded as soon as the first squares were shown, showing an absence of LI, and 50% showed a delay similar to the controls.

5.2. Clinical profile of the subjects and LI (Tables 3 and 4)

The acute schizophrenics without LI, according to the chosen criterion, were different from the others in the following ways: (1) older at the time of their first hospitalization \( (U = 24, p = 0.04) \) (mean: 26.8 vs 21.5 years old); (2) a lower total PANSS score \( (U = 8.5, p = 0.015) \); (3) a lower PANSS score for the subscale of negative symptoms \( (U = 11, p = 0.03) \); and (4) a lower PANSS score for the general subscale \( (U = 9, p = 0.017) \).

The acute schizophrenic patients without LI were no different from the others in the following ways: (1) the PANSS score for the subscale of positive symptoms \( (U = 27, NS) \); (2) the BPRS score \( (U = 49, NS) \); (3) the clinical subtype (chi-square = 3.6, NS); (4) their drug treatment status (drug-free, classical neuroleptics, atypical neuroleptics) (chi-square = 3.64, NS); and (5) the neuroleptic dose (mg/day Eq. CPZ) \( (U = 35, NS) \).

5.3. Clinical profile according to the degree of LI

In all preexposed subjects, the speed of finding the association between the square and the sound, correlated negatively with the sociocultural level of the parents \( (r = -0.44, p = 0.001) \).

For the schizophrenics in the acute phase, the speed of finding the association correlated negatively with their age at the time of their first hospitalization \( (r = -0.47, p = 0.03) \), as well as with the PANSS general subscale \( (r = -0.544, p = 0.02) \).

The only significant correlation for all of the schizophrenic patients between the speed of finding the association and the clinical characteristics, was the score for the PANSS negative subscale \( (r = -0.424, p = 0.017) \).
Table 3  
Characteristics of the subjects according to their latent inhibition status (\(\text{ns} = \text{not significant}\); educational level: 1 — baccalauréat + 4 and more; 2 — baccalauréat to Bac + 3, 3 — no Bac (Lycée), 4 — College, and 5 — primary school.)

<table>
<thead>
<tr>
<th>Acute schizophrenics</th>
<th>Sex</th>
<th>Age</th>
<th>Parents socio-cultural level</th>
<th>Education level</th>
<th>Medication dose Eq. CPZ (mg/j)</th>
<th>Age of first symptoms</th>
<th>Age at the first hospitalization</th>
<th>Length of evolution under treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>6</td>
<td>26.6 ± 9.5</td>
<td>3.44 ± 1.24</td>
<td>2.2 ± 1.13</td>
<td>230.5 ± 218</td>
<td>20 ± 4</td>
<td>21.1 ± 4.5</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>4</td>
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<tr>
<td>Latent inhibition</td>
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<tr>
<td>group ((N = 10))</td>
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<td>No latent inhibition</td>
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<td>0.03</td>
</tr>
</tbody>
</table>

\(\text{ns} = \text{not significant}\)
Table 4
Clinical characteristics of the subjects according to their latent inhibition status

<table>
<thead>
<tr>
<th>Acute schizophrenics</th>
<th>Latent inhibition group</th>
<th>No latent inhibition group</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANSS</td>
<td>90.55 ± 12.33</td>
<td>73.14 ± 11.93</td>
<td>2.84</td>
<td>0.01</td>
</tr>
<tr>
<td>Positive scale</td>
<td>16.44 ± 4.82</td>
<td>17.7 ± 7.34</td>
<td>0.49</td>
<td>ns</td>
</tr>
<tr>
<td>Negative scale</td>
<td>25.88 ± 4.6</td>
<td>18.86 ± 6.25</td>
<td>2.58</td>
<td>0.02</td>
</tr>
<tr>
<td>General scale</td>
<td>47.11 ± 9.62</td>
<td>36.6 ± 6.21</td>
<td>2.5</td>
<td>0.02</td>
</tr>
<tr>
<td>BPRS</td>
<td>50.5 ± 10.64</td>
<td>51.1 ± 13.8</td>
<td>0.01</td>
<td>ns</td>
</tr>
</tbody>
</table>

6. Discussion

Our paradigm based on a contingency detection method (Ginton et al., 1975) between two stimuli, demonstrates the LI phenomenon. Using the pre-defined LI criterion, the performance of the schizophrenic patients in the acute or chronic phases was different from that of the controls. In fact, we observed a loss of LI for acute schizophrenics, and an enhancement of LI for chronic schizophrenics. However, for the acute schizophrenics, the results were not homogeneous. The LI status of the patients in the acute phase appears to correlate with the clinical criteria with a prognostic value. We will discuss the variations in LI from the perspective of a disturbance in the attentional processes.

In the controls, the sensitivity of the test (80%) and its specificity (100%) according to their condition (preexposure or not) are comparable to those observed in controls with the LI tests used in Baruch’s (1988a,b) and Gray’s studies (1992a,b, 1995) (sensitivity 80%, specificity 80%). In Swerdlow’s study Swerdlow et al. (1996), who used the same paradigm, the sensitivity of the test was comparable, but its specificity was lower (50%). The authors attributed these differences to the type of sound stimuli used. In a second simpler test with visual stimuli, they obtained high specificity (100%), but low sensitivity (10%). The characteristics of the test that we developed allow the LI phenomenon to be demonstrated in healthy controls.

Since we included consecutive subjects, the gender split for condition has not been balanced in normals either in schizophrenic groups. Considering data from animal studies (Shalev et al., 1998), the difference of gender between normals and schizophrenics could have contributed to the results.

The schizophrenic patients showed an LI status that is significantly different from that of the controls, irrespective of whether they had chronic or acute schizophrenia. In the patients in the acute phase, the results showed that preexposure had no effect on the median scores, demonstrating the loss of LI. These results are the same as in Gray (1992a,b, 1995) and Baruch’s studies (1988a,b). These authors considered that the dopaminergic hypothesis of the LI phenomenon in schizophrenia (Carlsson, 1988; Cohen and Servan-Schreiber, 1992) is the reason for these performances. The patients in the acute phase were tested during the first 15 days of “antipsychotic” treatment, which is indeed too short a time to block the dopaminergic receptors totally (Gray et al., 1991). We found no difference for the drug treatment status (drug-free, atypical antipsychotic drug, classical neuroleptics), in contrast to the results reported in Williams’ study (1998).

We noted an LI enhancement in chronic schizophrenics, which was manifest by a learning delay significantly greater than for the controls. In LI studies in man, the performance of chronic schizophrenics has not been tested in terms of the intensity of the phenomenon. But animal studies take the LI enhancement into consideration, which the authors suggest may be a model of negative symptoms in schizophrenia (Weiner and Feldon, 1987; Murphy et al., 2000).

The group of acute schizophrenics obtained higher scores for BPRS and the positive PANSS subscale, than those in the chronic phase. But this dimension did not correlate with the scores obtained in the LI test. These results were consistent with previous studies (Gray et al., 1992a,b), in which the authors suggested that the positive symptomatology is not the exclusive consequence of dopaminergic hyperactivity.

An abolition of LI was observed during the acute phase, but not in the chronic phase of the disease,
reflecting a “state dependent” factor of the acute stage of schizophrenia. However during the test, the LI status allowed two groups of patients to be identified out of the acute patients. These differed on clinical and sociodemographic criteria: acute patients who had an abolition of LI exhibited lower scores for the negative and general subscales and older age when they were hospitalized for the first time. These data show the relationship between the absence of the LI phenomenon and prognostic criteria of schizophrenia. The excess of LI seen in the chronic schizophrenics correlated positively with the negative dimension of the PANSS scale. This statistical link is common to both the acute and chronic schizophrenic groups. For the schizophrenic patients, irrespective of whether their disease was acute or chronic, these results show a correlation between a disturbance in information processing and negative symptomatology.

According to Hemsley (1996), the absence of LI is a “weakening influence of stored regularities of the previous input”, which is the cause of a disorder of the detection of stimuli and of relevant responses in a test situation. A disorder of the influence of previous experiences would result in a disorder of selective attention.

During the test phase, the subjects without LI recognised the relationship between the appearance of the square and the sound, as soon as the square was shown the first few times. The absence of LI may be the result of a “over-attention” state during the mask task, in which the subjects focus their attention either on relevant stimuli (syllables to count) or irrelevant stimuli (squares). Usually, task irrelevant and redundant stimuli are automatically processed in normals subjects (Schneider et al., 1984). The patients without LI would be unable to discriminate relevant from irrelevant stimuli. They would allocate attentional resources to process both relevant and irrelevant stimuli. These results all together suggest that schizophrenia interferes with processes involved in automatization (i.e. from control to automatic processing). The absence of LI in the acute phase may be interpreted as a resource allocation dysregulation, as if quantitative or intensive processes tend to compensate for a qualitative disorder. This type of information processing was observed on patients with clinical features suggesting good prognosis. On the other hand, the acute patients without absence of LI would fail to elicit those compensatory processes and show clinical features suggesting poor prognosis. Excessive LI in patients in the chronic phase may be a sign of a more general dysfunction since NPE chronic schizophrenics also showed poor performances.

7. Conclusions

In our study, the absence of LI in the acute phase of schizophrenia, allows a subgroup of patients to be identified, who have recognized characteristics, such as criteria for a good prognosis of disease progression (low intensity of the negative dimension, late age at the first hospitalization) (Andreasen et al., 1990). The intensity of the LI phenomenon is increased in chronic schizophrenics in comparison with controls. The LI status of a schizophrenic patient does not seem to correlate with positive symptomatology (e.g. hallucinations, delusions etc.) or with neuroleptic treatment. It correlates with the negative dimension of schizophrenic disease. This correlation is found in schizophrenic patients, irrespective of whether their illness was acute or chronic, and suggests that the LI phenomenon may reflect a process, which is specific to the schizophrenic disorder. Nevertheless, further studies in other diagnostic category should be necessary to confirm this hypothesis. The LI paradigms may therefore be a relevant model for schizophrenia. These results show that more studies should be made to validate new LI paradigms and to examine the nature of this phenomenon in schizophrenia.

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References
