



Original article

On the correlation between perceptual inundation caused by realistic immersive environmental auditory scenes and the sensory gating inventory in schizophrenia



A. El-Kaim^{a,b,c}, M. Aramaki^d, S. Ystad^d, R. Kronland-Martinet^d, M. Cermolacce^{a,b,c}, J. Naudin^{a,b,c}, J. Vion-Dury^{a,b,c}, J.-A. Micoulaud-Franchi^{a,b,c,*}

^a Pôles de Psychiatrie « Solaris », CHU de Sainte-Marguerite, 270, boulevard de Sainte-Marguerite, 13009 Marseille, France

^b Unité de Neurophysiologie et Psychophysiology, Pôle de Psychiatrie Universitaire, CHU Sainte-Marguerite, 270, boulevard Sainte-Marguerite, 13009 Marseille, France

^c Laboratoire de Neurosciences Cognitives (LNC), UMR CNRS 7291, 31 Aix-Marseille Université, Site Saint-Charles, 3, place Victor-Hugo, 13331 Marseille cedex 3, France

^d Laboratoire de Mécanique et d'Acoustique, LMA, CNRS, UPR 7051, Aix-Marseille Université, Centrale Marseille, 13402 Marseille cedex 20, France

ARTICLE INFO

Article history:

Received 8 September 2014

Received in revised form 18 January 2015

Accepted 19 January 2015

Available online 18 February 2015

Keywords:

Schizophrenia

Sensory gating

P50

Perceptual anomalies

Self-report

ABSTRACT

Background: In schizophrenia, perceptual inundation related to sensory gating deficit can be evaluated “off-line” with the sensory gating inventory (SGI) and “on-line” during listening tests. However, no study investigated the relation between “off-line evaluation” and “on-line evaluation”. The present study investigates this relationship.

Methods: A sound corpus of 36 realistic environmental auditory scenes was obtained from a 3D immersive synthesizer. Twenty schizophrenic patients and twenty healthy subjects completed the SGI and evaluated the feeling of “inundation” from 1 (“null”) to 5 (“maximum”) for each auditory scene. Sensory gating deficit was evaluated in half of each population group with P50 suppression electrophysiological measure.

Results: Evaluation of inundation during sound listening was significantly higher in schizophrenia (3.25) compared to the control group (2.40, $P < .001$). The evaluation of inundation during the listening test correlated significantly with the perceptual modulation ($n = 20$, $\rho = .52$, $P = .029$) and the over-inclusion dimensions ($n = 20$, $\rho = .59$, $P = .01$) of the SGI in schizophrenic patients and with the P50 suppression for the entire group of controls and patients who performed ERP recordings ($n = 20$, $\rho = -.49$, $P = .027$).

Conclusion: An evaluation of the external validity of the SGI was obtained through listening tests. The ability to control acoustic parameters of each of the realistic immersive environmental auditory scenes might in future research make it possible to identify acoustic triggers related to perceptual inundation in schizophrenia.

© 2015 Elsevier Masson SAS. All rights reserved.

1. Introduction

Deficits in sensory gating in schizophrenia were suggested by the now-classic phenomenological study of McGhie and Chapman. In this study based on interviews, patients with schizophrenia reported being inundated by an overwhelming mass of sensory information, particularly in the auditory modalities [26,28,50]. Patients reported perceptual anomalies that they described as follows: “I listen to

sounds all the time. I let all the sounds come in that are there. I should really get an earphone and a wireless and control these sounds coming in so that at least I know they are separate from me” [28].

Hetrick et al. offered a reliable and valid self-report questionnaire called the sensory gating inventory (SGI) to explore retrospectively four phenomenological dimensions of sensory gating: perceptual modulation, over-inclusion, distractibility and fatigue-stress modulation. The SGI confirmed that an abnormal sensory gating experience relies mainly upon perceptual inundations [21]. Patients with schizophrenia reported SGI scores that were higher than in healthy subjects [33].

* Corresponding author. Pôle de Psychiatrie « Solaris », CHU de Sainte-Marguerite, 270, boulevard de Sainte-Marguerite, 13009 Marseille, France. Tel.: +33 6 22 36 40 19. E-mail address: jarthur.micoulaud@gmail.com (J.-A. Micoulaud-Franchi).

In the meanwhile, an evaluation of perceptual dimensions obtained during listening tests was designed [32]. The experimental paradigm consisted in asking the participants to listen to non-verbal complex sounds (i.e., environmental sounds, abstract sounds¹) and to evaluate (among other aspects) the feeling of “inundation” caused by the sounds by positioning a slider on a linear scale. Patients with schizophrenia evaluated environmental sounds (but not abstract sounds) as more inundating than healthy subjects [32]. This result was in line with previous studies, which revealed that patients with schizophrenia were more sensitive to urban noise than healthy subjects [45,46].

Sensory gating can also be assessed neurophysiologically with the auditory event-related potential (ERP) method by measuring P50 amplitude changes in a dual click conditioning-testing procedure [19]. The P50 component is a middle latency positive ERP component occurring around 50 msec after onset of a brief auditory stimulus [2]. In the conditioning-testing P50 procedure, the P50 amplitude is measured in a passive task in response to an auditory-paired click stimulus: S1 (conditioning stimulus) and S2 (testing stimulus). It is commonly observed in healthy subjects that the second P50 amplitude related to S2 is smaller than the first one (by more than half the amplitude of S1). By contrast, it was shown that this P50 suppression or “gating” after S2 could be deficient in schizophrenia patients [2,13] and that patients with high sensory gating deficit report the perception of being inundated and overwhelmed by external sensory stimuli assessed retrospectively by the SGI [33] or assessed during listening tests [32].

Although perceptual inundation is now considered as a core perceptual anomaly in schizophrenia [37,40], no study investigated the relation between retrospective evaluations of abnormal sensory gating experiences (“off-line evaluation”), evaluations obtained during listening tests (“on-line evaluation”) and P50 suppression [31]. Thus, one of the aims of the present study was to investigate these relationships related to perceptual inundation in schizophrenia and healthy subjects.

For that purpose, we:

- generated a sound corpus of realistic environmental sounds obtained from a 3D immersive synthesizer and designed a user interface to evaluate perceptual inundation during the listening test;
- compared the evaluations from a group of patients with schizophrenia and a group of healthy subjects;
- used a French version of the SGI recently translated and formally validated to retrospectively evaluate daily sensory gating experiences in the two groups [34];
- recorded event-related potentials in a dual click conditioning-testing paradigm in order to measure the P50 suppression which is known to be a neurophysiological parameter related to sensory gating [52], and to perceptual inundation in schizophrenia [32,33].

Our main hypotheses were:

- that patients with schizophrenia would rate the perceptual inundation higher than healthy subjects when listening to the sounds;
- that the level of perceptual inundation in this case would correlate with the SGI scores (in particular with some dimensions of the SGI) and with the P50 suppression.

The correlation with the SGI scores would constitute an original way of evaluating the external validity of the SGI and an important argument in favour of the relevance of perceptual inundation in schizophrenia. The correlation with the P50 suppression would also confirm previous findings on the relation between anomalies of sensory gating and perceptual inundation in schizophrenia [33].

2. Methods and materials

2.1. Participants

Twenty patients with chronic schizophrenia recruited from the Department of Psychiatry, Marseille University Hospital, France, constituted the group of schizophrenic patients. DSM-IV criteria, based on Structured Clinical Interview (SCID) for DSM-IV interviews, confirmed the diagnosis of schizophrenia [4,17]. The control group comprised twenty psychiatrically healthy subjects who were screened for any current or lifetime history of the DSM-IV axis I disorder, based on the Mini-International Neuropsychiatric Interview (MINI) [41]. They had no first-degree relatives with schizophrenia.

Exclusion criteria were reduced capacity to consent, a diagnosis other than schizophrenia on Axis I of the DSM-IV, auditory impairment, neurological illness, brain injury, severe non-psychiatric disease and mental retardation.

After receiving a detailed description of the study, participants gave their written informed consent. This study was conducted in accordance with the Declaration of Helsinki and Good French Clinical Practices. The data collection was approved by the *Commission nationale de l'informatique et des libertés* (CNIL number: 1223715).

2.2. Clinical measures

The Positive and Negative Syndrome Scale (PANSS) assessed the patients' clinical severity of illness [23]. The Clinical Global Impression (CGI) assessed the severity of the disorder [20]. All patients were medicated, clinically stable and had not been submitted to any change in medications for at least one month. The mean equivalent dose of chlorpromazine was calculated [16,53]. Data regarding age of onset, duration of disorder and number of hospitalizations were collected.

2.3. Perceptual evaluation during sound listening

2.3.1. Sounds

We designed a corpus of environmental sounds with the 3D immersive synthesizer “SPAD” (*Spatialized Additive Synthesizer for Environmental Sounds*) developed at the LMA [51]. The synthesizer enabled the generation of sounds by precisely manipulating intuitive control parameters linked to the physical attributes of the sources. The system presents three main advantages:

- the possibility of synthesizing a large variety of realistic environmental sounds;
- a precise control and selection of a broad range of acoustic parameters for each synthesized sound;
- an efficient generation of immersive environmental scenes (sound sources are virtually spatialized in a 3D space) representing the real sonic world [51].

Such an immersive system is believed to constitute a powerful tool to induce the feeling of inundation during sound listening. Furthermore, the ability to precisely control acoustic parameters might in future research make it possible to identify acoustic

¹ Abstract sounds are defined as unusual sounds that could not be easily associated with a physical sound source or a consensual perceptual meaning.

Download English Version:

<https://daneshyari.com/en/article/6229265>

Download Persian Version:

<https://daneshyari.com/article/6229265>

[Daneshyari.com](https://daneshyari.com)