Pseudoneglect in patients with temporal lobe epilepsy

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Background

Pseudoneglect consists in a tendency to overestimate the length of the left side of a line when healthy subjects perform the line bisection task (LBT). The main involvement of the right posterior parietal cortex and of the middle branch of the right superior longitudinal fascicle in visuospatial attention, was used to explain this leftward error (***1***). Recent studies demonstrated the association of the right superior temporal gyrus with left spatial neglect (***2***), although other works failed to assess a role of the temporal lobe in the LBT (***3***).
The *activation-orientation hypothesis* (***4***) states that the distribution of attention is biased in the direction opposite to the more activated hemisphere. Since visuospatial tasks such as line bisection involve activation of the right hemisphere, the activation-orientation hypothesis predicts that the left half of the horizontal line in a line-bisection task is the focus of greater attention.
To our knowledge, the LBT was not specifically studied in patients with epilepsy. The aim of the study is to investigate the performance of patients with temporal lobe epilepsy (TLE) in the LBT.

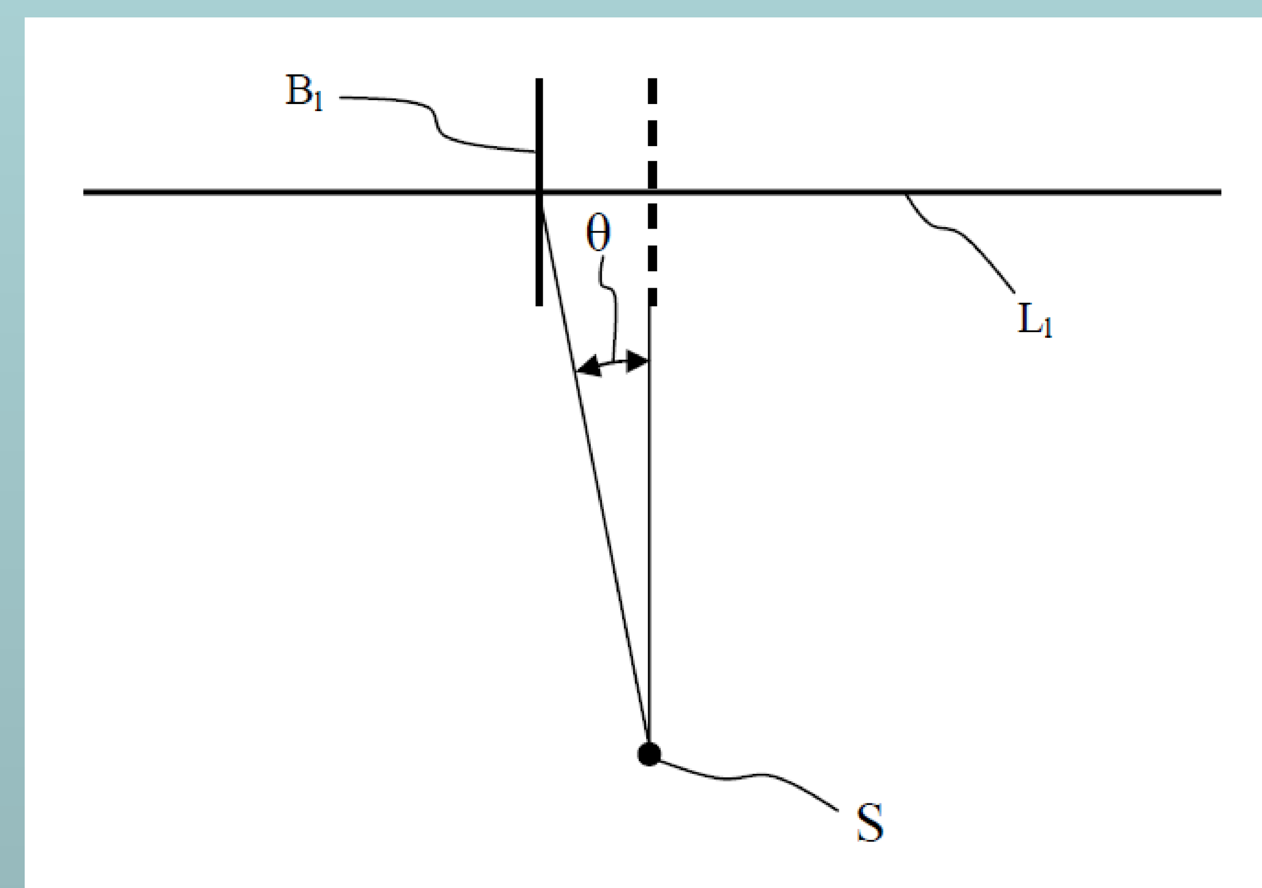

Fig. 1. Example of line stimulus used in the task. A subjects (S) see a horizontal line (L) transected by a small vertical line (B), located at a position (θ) ranging from -3 degrees (left bisected) to +3 degrees (right bisected) relative to the veridical center (dotted vertical line)

Subjects

The experimental task was conducted using a single PC laptop (Fujitsu Lifebook A544) running OpenSesame 2.9.7 software.
We recruited healthy subjects (n=18) and patients with right (RTLE, n=10) and left (LTLE, n=7) temporal lobe epilepsy, matched for sex (p=0.15), age (p=0.06) and education level (p=0.23). All patients received the electroclinical diagnosis of TLE at our Center for Epilepsy, according to diagnostic criteria (***ILAE, 1989***). There was no significant difference in disease duration between the two epileptic groups (p=0.06).
Patients performed the task at least two hours later the AED assumption; no seizures were reported in the last 72 hours. No history of head injury within the preceding ten years, of alcohol abuse, nor stroke was reported by participants. All subjects had normal or corrected to normal vision and hearing.

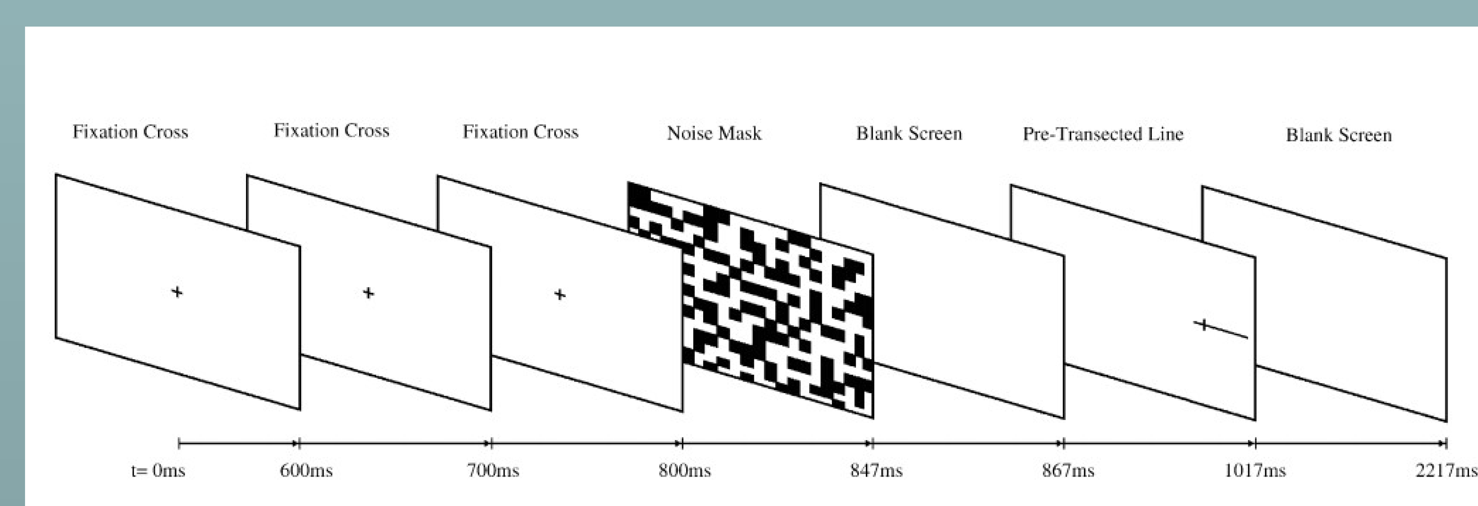

Fig. 2. Time course of stimulus presentation. A fixation cue was displayed three times prior to a noise mask, followed by the presentation of a pre-bisected line, located at random position on the screen. Answer is collected then a blank screen appear.

Methods

Subjects seated on a comfortable armchair, placed in a sound- and light- attenuated room. A computerized version of the LBT was used. Stimuli consisted in horizontal lines of various lengths and positions displayed on a monitor, transected by a short vertical bar, ranging in position from -3 degrees (left) to +3 degrees (right) relative to the veridical center (***Fig. 1***). On each task, participants judged whether the vertical bar was located to the left or to the right of the veridical center of the horizontal line (***Fig. 2***). There were 13 possible positions of the vertical bar, each repeated 9 times (a total of 117 tasks). A psychometric curve was fitted for each participant by probit analysis, using R 3.1.2. The point of inflection of curve (p50) and its slope (Weber ratio, WR) were calculated and compared between groups. The p50 point is an index of the location of the perceived bisection center. WR measures the subjective ability to discriminate between different space location of the vertical bar: higher is WR value, worse the ability to distinguish one interval from the others. WR and p50 were calculated and compared between groups, running a one-way analysis of variance (ANOVA).

Results

No significant difference was found in WR between the three groups [F(2,32)=1.3, p=0.28]. Mean p50 of healthy subjects was 0.014 degrees (95%CI: -0.12, 0.15); in RTLE group it was -0.008 degrees (95%CI: -0.18, 0.17), and in LTLE group 0.156 degrees (95%CI: -0.39, 0.71). No significant difference was found between the three groups [F(2,32)=0.513, p=0.604] (***Fig. 3***).

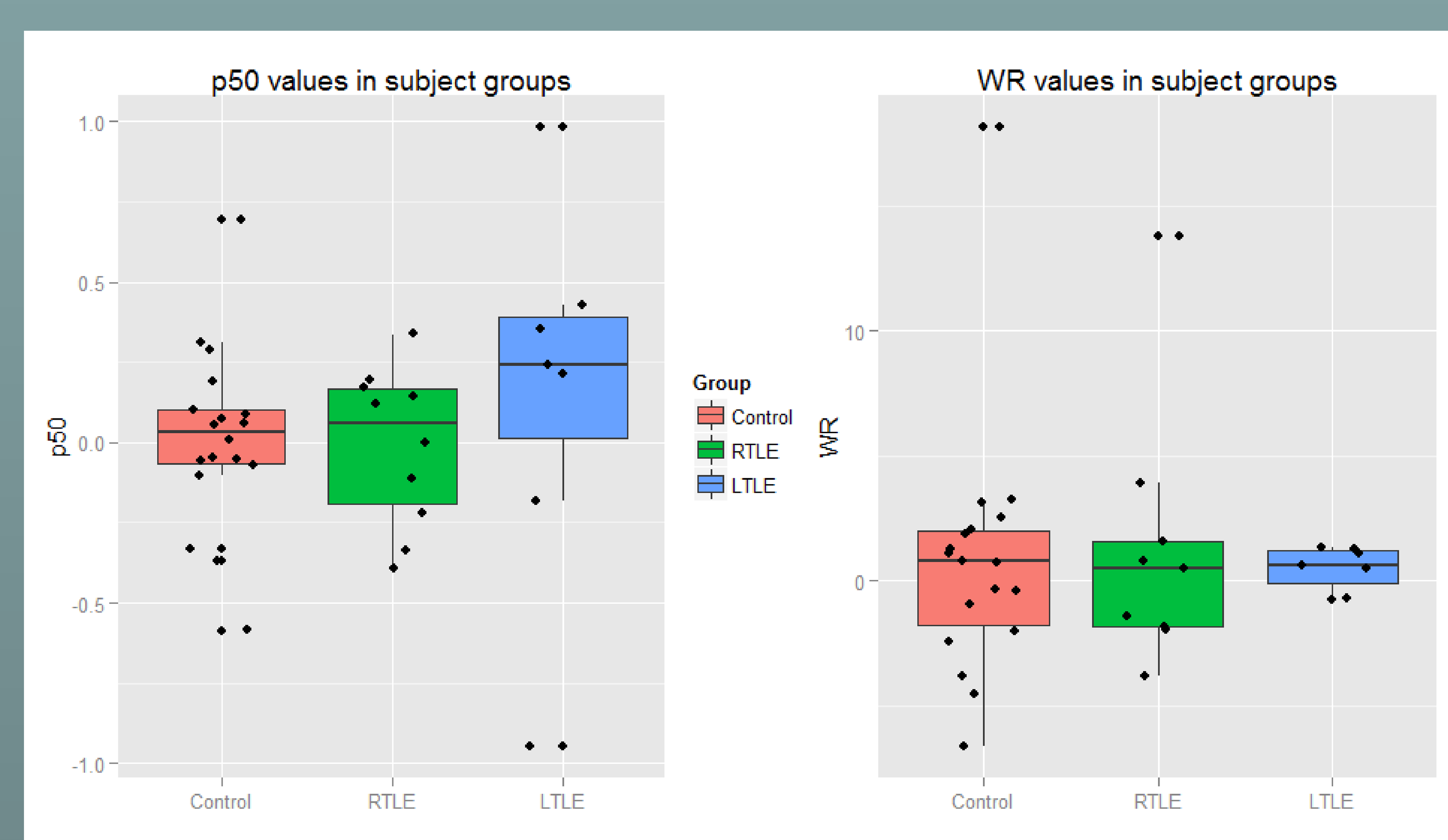

Fig. 3. Boxplot showing the p50 (left) and the WR (right) values computed for all subjects.

Discussion

WR values were similar in TLE patients and healthy subjects indicating that the discrimination ability was not affected by the disease.
Although not significant, patients with LTLE showed a rightward error, while healthy subjects and RTLE group perceived the center near to its veridical position. These preliminary data show that patients with LTLE may have alteration of the spatial awareness. A larger population is needed to confirm this hypothesis.
Another limitations of our study relies essentially on the possible effect of AEDs on spatial awareness. In view of this, we suggest that future experiments should recruit patients with unmedicated newly diagnosed TLE.

Bibliography

1. De Schotten, et al.. A lateralized brain network for visuospatial attention. *Nature neuroscience*, 2011; 14(10), 1245-1246.
2. Karnath, H. O., et al. Spatial awareness is a function of the temporal not the posterior parietal lobe. *Nature*, 2001; 411(6840), 950-953.
3. Rorden, C., et al. Disturbed line bisection is associated with posterior brain lesions. *Brain research*, 2006; 1080(1), 17-25.
4. Kinsbourne, M. The cerebral basis of lateral asymmetries in attention. *Acta psychologica*, 1970; 33, 193-201.