Over- and underestimation of language difficulties in left unilateral brain damaged patients

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INTRODUCTION

- Patients with aphasia may underestimate their language deficits (i.e., anosognosia). Recent research suggests that awareness of these deficits exists on a spectrum (over-/underestimation of deficits);
- The Dunning-Kruger effect (DKE) parallels anosognosia in the general population. The DKE suggests that people with limited ability overestimate their abilities, while people with high ability tend to underestimate themselves;

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- In neurological conditions such as aphasia, severe cases may underestimate their deficits, while milder cases tend to overestimate;
- It's not clear whether the DK is a psychological phenomenon or a statistical artifact;
- The influence of "*regression to the mean*" within the DKE highlights its statistical nature and its potential to be a confound in patient studies, leading to inaccurate assessments of deficits;
- Indeed, including 'extreme performers' during tolerance levels analyses may have an impact on cut-offs and later diagnosis of distorted awareness.

Aims of the study

1. To assess bidirectional misestimation in awareness of language impairments following unilateral brain damage;
2. To determine whether the patients' actual language abilities could predict the extent of misestimation error;
3. In doing so, we investigated the role of statistical biases in impaired awareness and re-evaluated the established cut-offs of the VATA-L.

MATERIAL AND METHODS

Participants

Demographics	
N	78 (36 females, 42 males; 66 were tested in Italy, 12 were tested in the UK).
Age	Mean=60.2, SD=15.5, range 19-86
Handiness	N=73 (right-handed), N=3 (left-handed), N=2 (ambidextrous)
Nature of lesion	• Vascular causes (N=66); Ischemia (N=46), haemorrhage (N=20); • TBI (N=7); • Missing (N=5)
Time from lesion (months)	Mean=16.3, SD=39.7, range=1-192

Inclusion criteria

a) Confirmation of an acquired left-hemisphere brain injury through magnetic resonance imaging (MRI) or computerised tomography (CT);
b) A diagnosis of aphasia confirmed by the healthcare team, and;
c) No history of neurological conditions.

Procedures

Language Assessment: For Italian speakers: the Aachen Aphasia Test (AAT; Luzzati, Willmes, and De Bleser, 1996); For English speakers: Western Aphasia Battery – Revised (WAB-R; Kertesz, 1982).

Awareness Measurement: Visual-Analogue Test Assessing Anosognosia for Language Impairment (VATA-L; Cocchini et al., 2010.).

RESULTS

Over-underestimation of language deficits in left unilateral brain damaged patients

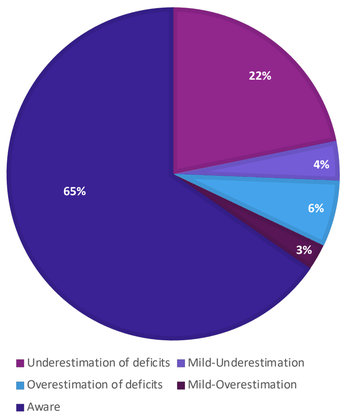

Figure 1: Percentages of distortions of awareness in our sample

Differences between the aware/unaware group	Significancy
Age	NS
Lesion onset (months)	Unaware group had more recent injuries (M=5.23, SD = 6.46) compared to the aware group (M=20.8,SD = 46.2), t(5.9) = -2.44, p = 0.01, Cohen's d = 0.47).
Type of brain lesion	NS
Language group	NS

1. Underestimation (i.e., anosognosia) was the main tendency in our sample (*Fisher Test*, p < 0.001, **Figure 1**);
2. No significant difference in the extent of error between underestimation and overestimation (*Welch's tests on absolute value of the scores:* t(71.4) = 1.83, p = 0.07, Cohen's d = 0.41).

Relationship between self-estimation error and aphasia degree

1. Severe aphasic patients had the highest scores (i.e., underestimation of deficits). Mild and moderate aphasic patients showed no clear pattern of self-estimation error (***Figure 2***);
2. There is only a trend between aphasia degree and self-estimation error (R^2 = 0.046, F(1, 68) = 3.33, p = 0.07; ***Figure 3***);
3. The relationship is not significant when individuals with the most severe and mild forms of aphasia have been excluded *(R^2=0.04, F(1,52)=2.17, t(52)=-1.47, p=0.147).*

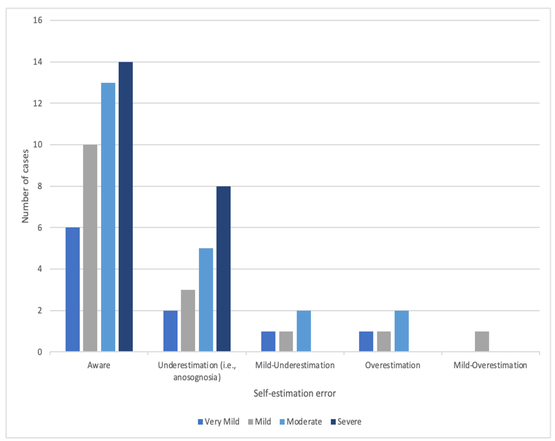

Figure 2: Number of cases of distortions of awareness in our sample divided by awareness level and aphasia degree

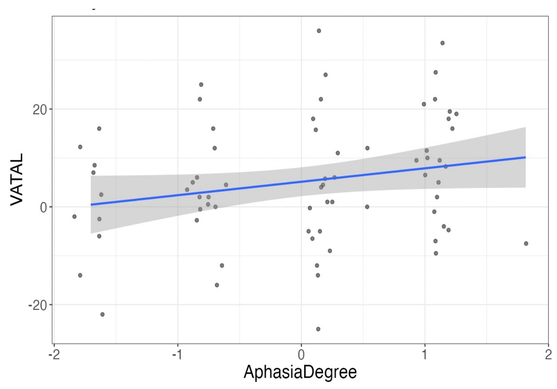

Figure 3: Relationship between aphasia degree and self-estimation error (VATAL) including extreme cases

Addressing the impact of 'extreme performers' during confidence level analyses

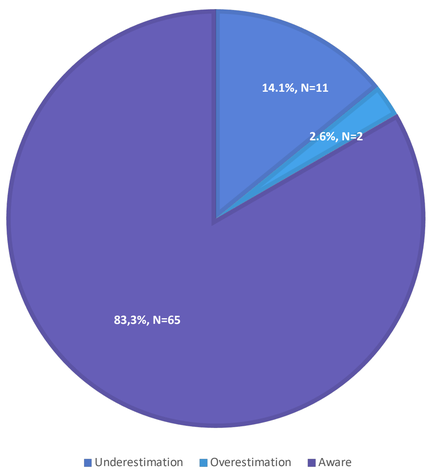

Figure 4: Percentages of distortions of awareness in our sample with conservative cut-offs

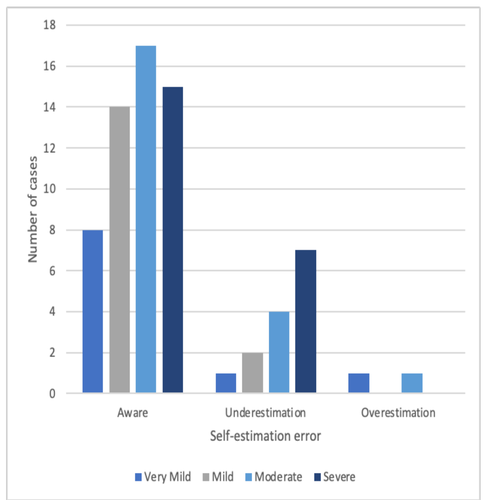

Figure 5: Number of cases of distortions of awareness in our sample divided by awareness level and aphasia degree

- To address statistical biases, we excluded 12 individuals with minimal language impairment and 11 individuals with severe language impairment;

RESULTS

- We implemented recalibrated cut-offs through Bootstrap resampling (1,000 iterations). With the new conservative cut- offs we found a reduced number of cases of distorted awareness;
- Underestimation of deficits decreased from 21.8% to 14.1%, and and overestimation of deficits decreased from 6.4% to 2.6% (***Figure 4***);
- Underestimation remains the main tendency in the sample (*Fisher Test*, p<0.001, ***Figure 4***).

KEY POINTS & DISCUSSION

- Self-estimation error persists even when extreme cases are taken into account;
- We did not find clear and predominant evidence that the DKE effect and regression to the mean have a significant impact on the assessment of awareness in aphasic patients;
- Underestimation of deficits (e.g., anosognosia) was the main tendency in our sample;
- Patients under-/overestimate their language skills to the same extent;
- This is particularly important given the composition of our sample, which included patients with unilateral brain injury, a population that has often been overlooked in the topic of anosognosia for aphasia.

LIMITATIONS

- Although the power sensitivity analysis suggests that our sample was large enough to reliably detect the observed effect sizes, a larger sample may still be desirable;
- The relatively small sample size in this study could have led to the Dunning Kruger effect's absence. It's therefore worth exploring whether regressive estimates might pose a more significant challenge in larger datasets.

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