Tracking participants' behaviour when performing linguistic tasks

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Abstract

This study aims to identify behaviours that accompany the psychological processes involved in reading sentences and deciding on a response. The response times of different participants' actions while they completed a questionnaire were measured. We focus on two datasets from the sample: cases in which participants changed their responses and cases in which they did not. The results show that changing the response has an impact on response times. More importantly, this impact occurs not only during the decision-making process but also throughout the task. This research may contribute to a better understanding of response time data in off-line techniques and to fine-tuning experimental designs.

Keywords: Psycholinguistics; off-line task; plausibility judgement; acceptability judgement; decision-making process

Introduction

The experimental approach has contributed to a better understanding of the cognitive mechanisms involved in language comprehension and production from on-line and off-line techniques (cf., e.g., Fernández & Cairns, 2018). However, serious concerns have been raised in the literature regarding methodological issues of the experiments, sometimes subtle but which can influence in many ways the results. Off-line data from judgments about the well-formedness of linguistic stimuli are also subject to debate on methodological issues (e.g., Langsford et al., 2019, Leivada & Westergaard, 2020, Schütze & Sprouse, 2013).

Regarding data analysis and interpretation, in the experimental approach, the association of question-answering times and the variables of interest can be tricky because time measures are influenced by multiple variables and unknown factors (Whelan, 2008). While this is true for outputs of both on-line and off-line techniques, researchers have prioritised the use of the former over the latter. On-line techniques are supposed to capture participants' automatic processes in response to a linguistic stimulus. In contrast, off-line techniques capture the participants' conscious and reflexive processes in response to it.

They are thus more likely to be influenced by extra-linguistic variables (e.g., individual differences in working memory, attention, and degree of engagement with or during the task).

In this work, we defend a more systematic attention to off-line techniques and the value of the time measures extracted through them in linguistic and psycholinguistic research. Our interest lies in participants' behaviours during task performance to identify signals regarding the degree of confidence, hesitation and engagement while deciding on a response. One of these behaviours refers to changes in responses and will be addressed in this paper.

Method

We analysed a dataset with 7,791 observations from questionnaires applied to 163 native Brazilian Portuguese speakers (M age=27.45, SD=10.82; 118 females) with an undergraduate or a postgraduate degree in progress or completed. The dataset is part of another study carried out by the authors (Lourenço-Gomes et al., in prep.).

The materials consisted of 16 experimental sentences and 32 fillers and participants were instructed to indicate, on a 7-item Likert-type scale, the extent to which the situation described in each sentence seemed acceptable or realistic (1=not at all plausible; 7=totally plausible). Participants had to fill in a consent form and a demographic and linguistic data form to complete the questionnaire.

The questionnaires were implemented in a *JavaScript* web-based application that records (1) the responses, (2) any changes in responses, (3) how many times they are changed, and the time spent on (4) reading the stimuli, (5) marking the responses, and (6) submitting them before proceeding to the following sentence. The study is part of an ongoing Project (Lourenço-Gomes, 2019) and had the approval of the ethics committee.

Results

The response times were categorized into five groups with probability quantiles for the statistical analyses. This approach was used as an alternative to the more commonly used data treatment since the distribution of response times is highly skewed positive, and we have chosen not to exclude any observations (considered outliers) nor proceed with a transformation in the data (cf. Whelan, 2008, for a discussion). Our focus in this study is on general participant behaviours accompanying the performance of a linguistic task. Thus, we consider all time measures to be informative. R (version 4.2.0) and IBM SPSS (version 27.0.1.0) software were used for the analyses.

With regard to the overall behaviour of the sample, the following was observed: (i) 550 cases (7.06%, of 7,991) of response changes in 142 participants (87.12%); (ii) in most cases (434, 78.91%), two responses were marked for the same item, and less frequently three (92, 16.73%) and between

four and six (24, 4.36%); (iii) the number of items with response changes in the same questionnaire varied between subjects (Min. = 1, Max. = 12, M = 3.87, SD = 2.73).

For the cases with no response change (NRC) we found a uniform distribution of response times across the categorised time groups and no significant difference was reached. In contrast, in the response change (RC) cases, a clear effect on the distribution of response times across time classes was observed throughout the task (Figure 1).

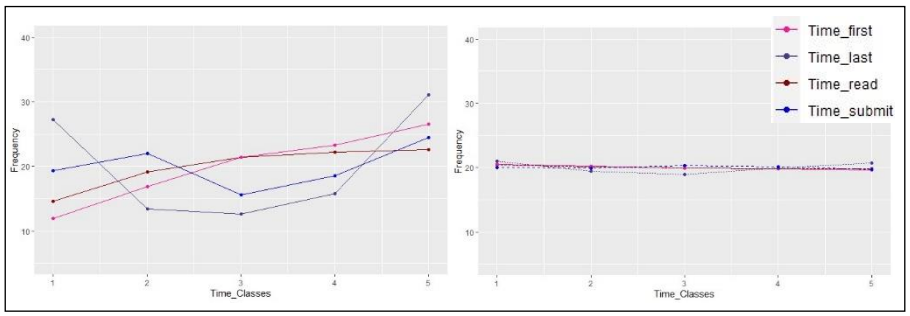

Figure 1. Graphic representation of the contrast in the data distribution across time classes in cases with response changes (RC, on the left) and with no response changes (NRC, on the right)

The results of the RC cases are as follows: The analysis showed significant differences in (i) time to read a sentence (χ^2=11.302, df=4; p=0.023). A lower percentage of observations (14.6%) were in the class with the lowest reading times; (ii) time to mark a first response (χ^2=33.762, df=4; p<0.001). A higher percentage was clustered in the highest time class (26.5%) while 11.9% were in the lower time class; (iii) time to mark the last response (χ^2=53.763, df=4; p<0.001). A high percentage of observations (31.1%) was found in the highest and lowest time classes (27.2%); and (iv) time to submit the response (χ^2=11.925, df=4; p=0.018). The distribution of observations in the most extreme time classes did not vary markedly in this parameter compared to the others (19.3%, 22%, 15.6%, 18.5% and 24.5%, from the lowest to the highest time classes, respectively).

Considering all cases (RC and NRC), a significant association was found among: (i) reading time and time to mark the last response (χ^2=639.502, df=16, p<0.001). Lower and higher reading times were associated, respectively, with lower and higher times to mark the last response; (ii) reading time and time to submit a response (χ^2=478.251, df=16, p<0.001). A high concentration of cases (51.3%) in the lowest time class was found; (iii) time to mark last response and time to submit a response (χ^2=2641,102, df=16, p<0.001), where the concentration of cases was in the lowest time classes.

Final remarks

There is a justified concern among researchers with the object of study, experimental design, materials, and data treatment and method of analysis. Although assumed, participants' general behaviours that may influence outcomes seem underexplored. By tradition, they have been included in a generic category as "extra-linguistic variables". Perhaps, as a result, much is lost in interpreting the data. The work presented is part of an endeavour to pursue clues as to the degree of confidence and hesitation in participants' responses and engagement while performing linguistic tasks. Although still exploratory, the topic is hoped to motivate further reflection and inspire future work.

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