Object function and manipulation knowledge: presentation of an Event-Related Potentials study

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INTRODUCTION

Semantic knowledge includes knowledge about general culture, language but also about objects. Critical knowledge about objects includes "**object function**" (i.e. the final goal of an object; e.g. the function of a piano is to play music) and "**object manipulation**" (i.e. the appropriate specific gestures allowing the correct use of an object; e.g. typing with the fingers). Collette et *al.* (2016) have shown that priming effects could be highlighted from function and manipulation related primes compared to semantically unrelated.

The present study aims to investigate the electrophysiological activity associated to the semantic priming by function and manipulation object features through word-stimuli.

METHOD

Participants: Twenty-six right-handed healthy adults (22 years old +/- 3.1) .
Material: Sixteen object-word targets were associated with three types of object-word prime (see Table 1): one sharing the same function (e.g. sandglass-stopwatch); another the same gesture of use (e.g. lighter-stopwatch) and finally an unrelated prime (e.g. knife-stopwatch). Lists od stimuli were controlled for familiarity, Age of Acquisition, imageability, frequency and length, with no difference between priming contexts.
EEG recording: 64+2 channel Biosemi cap; sample rate: 1024Hz.

Table 1. Prime and target types

PRIME			TARGET	
RELATED		UNRELATED	WORD	PSEUDOWORD
FUNCTION	MANIPULATION			
sandglass	lighter	knife	stopwatch	neerle

Task: Lexical decision task associated to a semantic priming paradigm. The participants had to decide by pressing a response box whether the target-word was a real word or a pseudo-word. The Stimulus Onset Asynchrony was set at 190 ms (see figure 1).

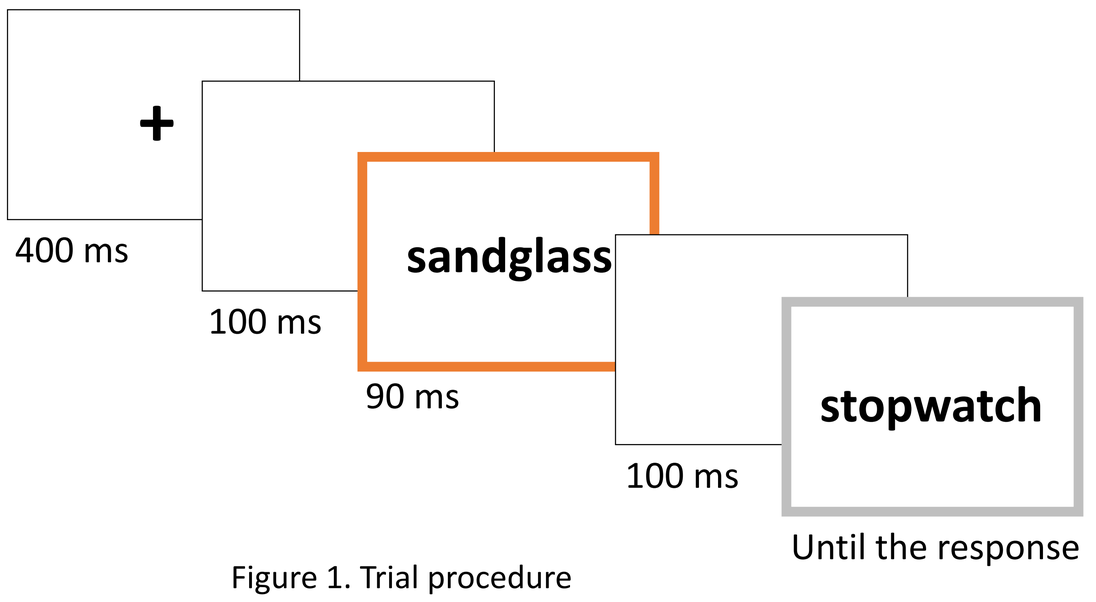

Figure 1. Trial procedure

RESULTS

• Response times (N=26 participants)

Function and Manipulation related priming contexts yielded a facilitative effect compared to the unrelated one, with no difference between the two (see figure 2).

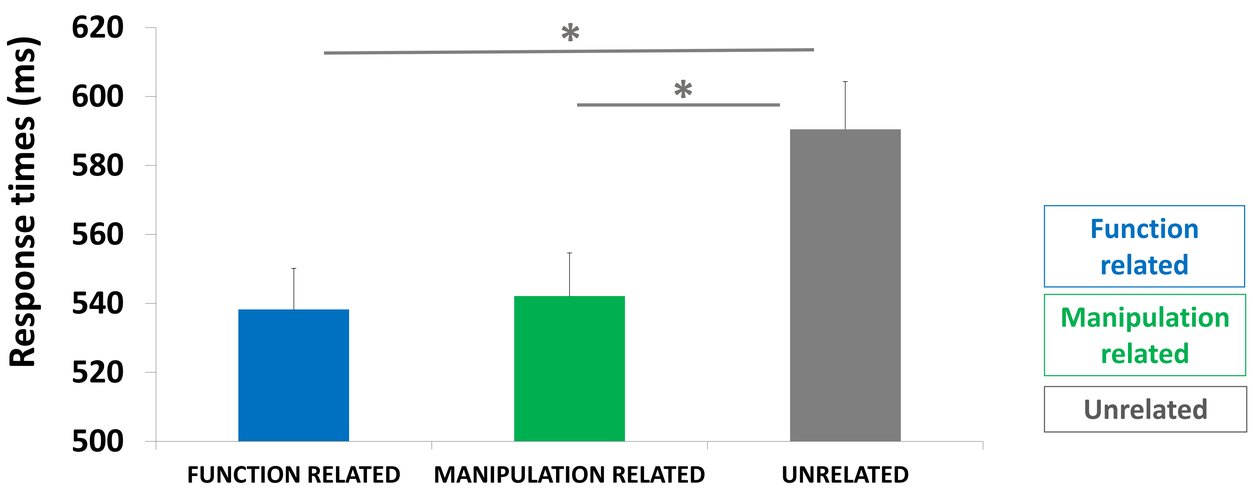

Figure 2. Lexical decision response times and standard errors depending on the priming context . Asterisks correspond to p <.001

• Event-related potentials (N=6 participants)

Late components (N400-like) has been identified both following the prime (a) and the target (b) (see figure 3.)

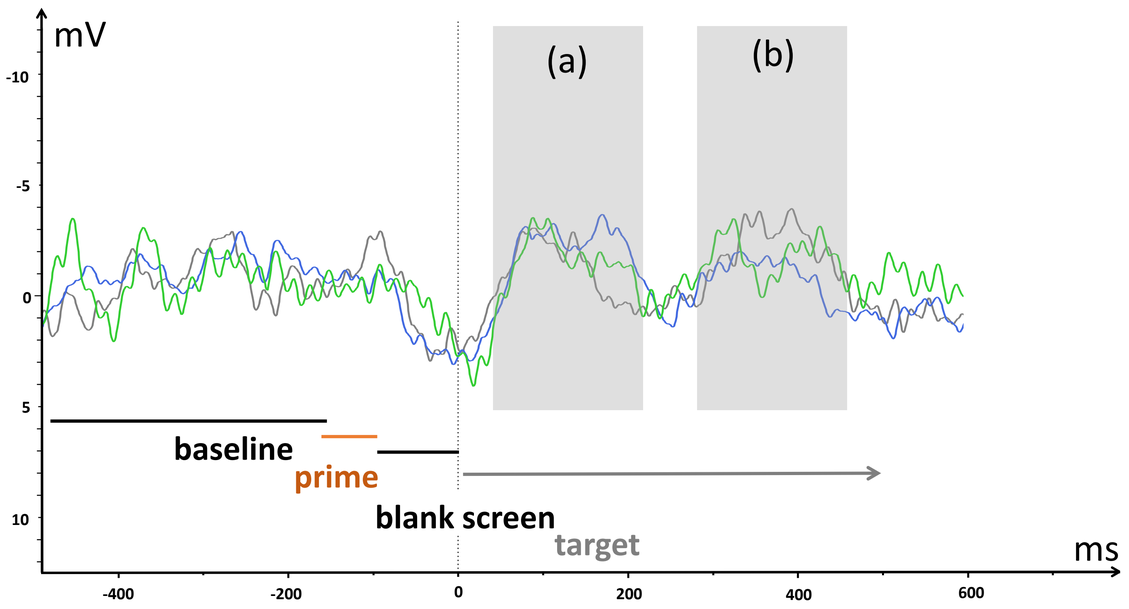

Figure 3. Grand average (n=6) on frontal electrod sites in each priming contexts.

DISCUSSION

As predicted, **function and manipulation related primes lead to priming effects** at the behavioral level. Moreover, an **N400-like late component**, usually used as semantic access marker, was identified both after the prime and the target presentation. The forthcoming analyses will allow us to statistically compare peak latencies and amplitudes in the different priming contexts. Given that we controlled prime-words in terms of psycholinguistic features, we expect no differences for the **prime semantic access** between priming contexts. By contrast, the priming effects should be observed during the target processing. We predict amplitude **differences between related and unrelated contexts** and **a delay for manipulation processing** due to its non declarative format compared to function (Squire, 1992).

Reference: Collette, C., Bonnotte, I., Jacquemont, C., Kalénine, S., & Bartolo, A. (2016). The development of object function and manipulation knowledge: evidence from a semantic priming study. *Frontiers in Psychology: Cognitive Sciences, 7:1239.;* Squire, L. R. (1992). Declarative and nondeclarative memory: Multiple brain systems supporting learning and memory. *Journal of cognitive neuroscience*, *4*(3), 232-243.