# Metaphorical priming in a lexical decision task in high functioning autism

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## 1 Introduction:

The difficulties experienced by autistic individuals with regard to communication and language are widely known and well documented. Individuals with High functioning autism (ASD) are distinguished by relative preservation of linguistic and cognitive skills. However, problems with pragmatic language skills have been consistently reported across the autistic spectrum, even when structural language is intact. Many studies establish failure to understand metaphors, idioms and other forms of figurative language (Gold & Faust, 2010; Vulchanova, Talcott, Vulchanov & Stankova, 2012). Figurative language takes many forms, conceptual metaphors being one of the most common. On the cognitive level, conceptual metaphors are the mental representations we establish in order to map between two domains (Lakoff & Johnson 1980; Fauconnier 1985; Vulchanova, Saldaña, Chahboun & Vulchanov 2015). In other words, the logic of one conceptual domain is applied to another.

Several studies have shown impaired figurative language in ASD populations. One of the first studies in figurative language in autism for instance was that of Happé (1995). She used 3 types of expressions: synonyms, similes, and metaphors. The underlying assumption of this study is that, in order to understand these kinds of expressions, we need to be able to "decode" the intentions and ideas of person to whom we are talking. The findings from this study showed that metaphor comprehension is impaired in individuals with autism.

Our hypothesis in this study is that this deficient metaphorical ability might depend, not only in the type of figurative expression (regarding the novelty or conventionality of it), but also on the way these expressions are perceived. This is especially relevant for individuals with ASD who need specific ways of integrating inputs, such as the ways in which the type of instruction can drastically change the reading comprehension in this population (Micai, Vulchanova & Saldaña 2015). In the current study, we test responses to metaphorical expressions and whether or not metaphors solicit priming for literal or rather the appropriate figurative interpretation in high-functioning children and adolescents with ASD.

These tests are carried out through a cross modal priming task. Priming is a process occurring outside conscious awareness, and thus differs from direct retrieval. It is an effect of retrieval from implicit memory, creating a heightened sensitivity to certain stimuli. In general, priming effects are found between lexical items which share a semantic component or a semantic association. For example, *angel* is recognized quicker, if it is followed by *wings* than,




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say, *table*. Here we exploit priming to reveal how metaphorical expressions are associated with figurative as opposed to literal interpretations in individuals with ASD. We are also interested in whether or not the modality of presentation of the stimuli (auditory vs. written) has an effect on their processing, as already established in on-going research (Chahboun, Vulchanov, Saldaña & Vulchanova, 2015).

## 2 Method:

### 2.1 Participants:

Two age groups of high-functioning ASD participants (N=48) and controls (N=39) were included (all native speakers of Spanish),each group has 2 age ranges

- **Group 1**: Age range 10-12.

Control group (N=18) and ASD group (N=26).

- **Group 2:** Age range 16-20.

Control group (N=21) and ASD group (N=22).

Participants and their legal tutors (usually the parents) provided written consent for entry into the study. Most of the individuals had participated in an earlier study (Chahboun et al 2015).

The diagnosis of ASD was confirmed according to the Autism Diagnostic Observation Schedule (ADOS) and also with the Autism Quotient (AQ).

We also made sure the participants do not have any structural language deficit. In addition to measuring the general IQ with the Weschler Scale (WISC IV or WAIS) we measured the participants' receptive vocabulary (British Picture Vocabulary Scale), their grammatical language level (CEG: Test of comprehension of grammatical structures) and theory of mind.

### 2.2 Apparatus and Stimuli:

Stimuli were displayed on a color monitor controlled by E-prime software implemented on a Dell compatible laptop.

Responses were collected with a response box; response accuracy (ACC) and reaction times (RTs) were measured by the E-prime software. The stimuli included 36 prime expressions classified into 3 different types: novel metaphors, conventional metaphors and free combinations (non- metaphorical expressions), all comprising a noun and a modifier. The target words were semantically related to the prime expressions. On half of the instances for each group of expressions, targets were related to the figurative interpretation of the prime, the remaining half were related to the literal meaning (cf. Figure1.)

In a pilot study with 150 adult native speakers of Spanish, we determined the degree of familiarity of the metaphors. This allowed us to verify the conventionality of the metaphors or their novelty, and their inclusion in the test stimuli. The same number of filler expressions (N=36) were added, respectively as primes, and non-words served as targets. Thus, each participant responded in total to 72 trials, 36 in each modality: visual modality (stimuli presented orthographically) and auditory (stimuli presented auditorily). The experiment was designed as a lexical decision task on the target word.

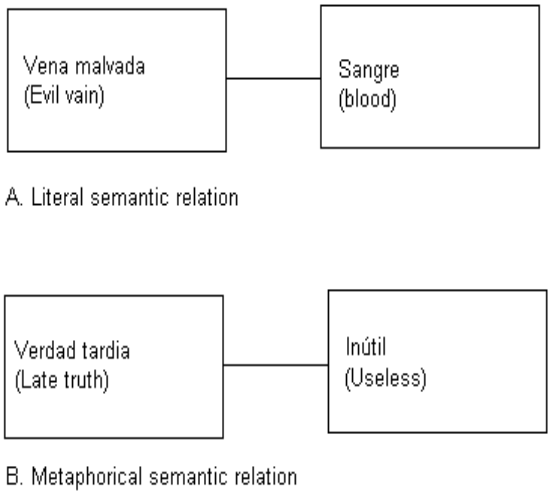


**Figure 1: Examples of the targets semantically related used: Literal or metaphorical relation**

### 2.3 Procedure:

Each participant was tested individually in a single session. Participants either saw the prime expression on a computer screen or heard it via loud-speakers. The timing of the specific stimulus events on each trial was as follows: (1) The prime is presented as visual text on the screen or auditorily via the loud-speakers (depending on the experimental block ); (2) a fixation point is presented followed by a delay of 400 ms as a latency; (3) a target is presented as word or non-word; (4) Finally, participants have to decide whether the target is a word or not in Spanish (cf. Figure 2.).

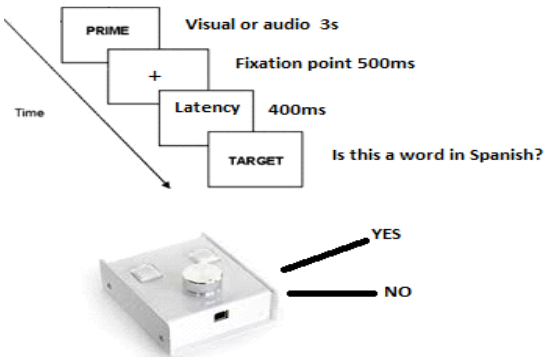


**Figure 2: Sequence of events for the trials of the experiment.**

### 3 Preliminary results:

The data of both the control and experimental group (N=19) were analysed with R. A linear mixed model analysis on RTs revealed a significant interaction between presentation modality and conventionality of the metaphors ($p<.05$), with poorer performance of the ASD group when the prime was presented auditorily. Furthermore, there was an interaction between group and age, with younger groups taking more time to respond. Finally, the results showed a significant interaction between modality, type of target and age. The younger groups' performance was slower when the prime was presented auditorily, and when the target relationship with the prime was figurative. Regarding accuracy, with a generalized linear mixed model (R) we found significant interactions depending on the modality of the prime. The ASD groups were less accurate in the auditory modality, in contrast with the control groups. Moreover, the results show a significant interaction between conventional metaphors and age in both groups. There was a significant interaction between the type of target, modality and age. Finally, a main effect of group, a main effect of age and an interaction of age and group were observed The typically developing participants were more accurate in both age ranges. In both the experimental and the control group, the older participants performed better than the younger ones, and the difference in performance between the age ranges in the ASD group was greater than in the control group.

## 4 Conclusions:

Most of the available literature and previous studies, using a range of different methodologies, consistently demonstrate that figurative language is demanding for ASD populations.

In particular, metaphors present a difficulty in terms of processing for the ASD group. The preliminary results of this study confirm our earlier findings that the auditory modality is more demanding for the ASD group. Surprisingly, the significant effect we found for accuracy was confined to the conventional metaphors. An explanation can be sought in the difference between conventional and novel metaphors.

Conventional metaphors are less transparent, making them more problematic compared to novel metaphors, as these might be processed without the need for prior familiarity.

These results support the findings in Chahboun et al (2015), where a similar effect was found for idioms contra novel metaphors. Idioms are similar to conventional metaphors in that both types of expression are less transparent than both literal expressions and novel metaphors.

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