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All the world's a stage: Evaluation of two stages of metaphor comprehension in people with autism spectrum disorder

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ABSTRACT

Purpose: Individuals with autism spectrum disorder (ASD) are commonly believed to have difficulty understanding figurative language; however, recent evidence suggests that these difficulties may reflect processing differences as opposed to inability to comprehend. The purpose of the present study was to evaluate whether processing of metaphorical and non-metaphorical sentences in individuals with ASD is the same as or different from individuals without ASD.
Methodology: We investigated generation of metaphorical meaning and suppression of literal meaning in high-functioning individuals with ASD and controls. Groups were matched for semantic knowledge and IQ. Individuals completed a sentence decision task designed to evaluate presence of metaphorical meaning.
Results: We found that people with ASD generated the literal and figurative meanings for metaphors similarly to controls, but had more difficulty inhibiting the unintended meaning than the control group.
Conclusions: We provide evidence that people with ASD do not have difficulty with generating figurative meaning, but that the stage of suppression should be further investigated.

1. Introduction

Comprehension of figurative language, that is, language that has one or more intended meanings in addition to the literal interpretation (Colich et al., 2012; Laval, 2003), is an everyday skill that contributes to educational achievement (Cain, Oakhill, & Lemmon, 2005; Kerbell & Grunwell, 1997; Nippold & Martin, 1989) and social participation (Kerbell & Grunwell, 1997; Laval, 2003; Swineford, Thurm, Baird, Wetherby, & Swedo, 2014). In educational settings, figurative language comprises up to 36% of the language that children are exposed to (Lazar, Warr-Leeper, Nicholson, & Johnson, 1989), with teachers using approximately 1.73 idioms per minute (Kerbell & Grunwell, 1997). For adults, up to 25% of utterances are instances of figurative language (Van Lancker-Sidtis & Rallon, 2004).

For speakers with autism spectrum disorder (ASD), over-literal interpretation of language is consistently reported as characteristic (Happe, 1993, 1994, 1997; Happe & Frith, 1991; MacKay & Shaw, 2004; Minshew, Goldstein, & Siegel, 1995;

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Tager-Flusberg, Paul, & Lord, 2005). However, recent research showed that high-functioning children with ASD (i.e., those with nonverbal IQs; NVIQs >80), with semantic knowledge (Norbury, 2004, 2005b) or verbal IQs (VIQs; Gold, Faust, & Goldstein, 2010) similar to their peers, deciphered figurative meaning as accurately as controls. Nonetheless, even when equally accurate, individuals with ASD often required longer than controls (Gold et al., 2010). In other studies where ASD participants and controls were matched using VIQ (Wang, Sigman, & Dapretto, 2006) or years of education (Giora, Gazal, Goldstein, Fein, & Stringaris, 2012), but not specifically on language skills, ASD participants scored less accurately than their peers. Even, so, they scored above chance, indicating that individuals with ASD were not consistently biased toward the literal meaning. Again, individuals with ASD consistently required longer than controls (Giora et al., 2012) or the response times were not reported (Wang et al., 2006). The pattern of accuracy and response time differences between high-functioning individuals with ASD and matched controls may suggest that although both groups are able to accurately decipher figurative language, they are using different processes to do so. The current study aimed to investigate the cognitive processes that underlie metaphor comprehension in high-functioning individuals with ASD.

1.1. Figurative language processing

Figurative language comprehension proceeds in stages (Glucksberg, Gildea, & Bookin, 1982; Norbury, 2005a). To comprehend figurative language, an individual must: (1) access the relevant information about the words that make up the utterance (Evans & Gamble, 1988; Jung-Beeman, 2005; Vosniadou, 1987); (2) integrate the relevant information to generate both the literal and the nonliteral meanings of the sentence (Glucksberg et al., 1982; Jung-Beeman, 2005; Keysar, 1989); and (3) select the intended meaning (Jung-Beeman, 2005), which requires inhibition or suppression of the unintended meaning (Gernsbacher & Robertson, 1999; Glucksberg et al., 1982). Success at each stage, and hence overall, depends on and is influenced by relevant contextual information (e.g., facial expression, tone of voice, knowledge of events, and knowledge of speaker's intention).

1.1.1. Models of figurative language processing

Stage 2 (*integration*) of figurative language processing involves the elaboration and refinement of higher order semantic relations from stage 1 to obtain message level interpretation (Jung-Beeman, 2005). Traditionally, there have been two opposing models of the integration stage in controls. One model proposed serial processing; that is, the literal meaning would be generated first, then kept or discarded depending upon the context of the particular situation. If discarded, the nonliteral meaning would then be generated (Clark & Lucy, 1975; Janus & Bever, 1985). In contrast, the simultaneous model proposed that the literal and nonliteral meanings were generated simultaneously, after which the irrelevant meaning would be inhibited or suppressed. In 1982, Glucksberg et al. (1982) provided evidence for the simultaneous model by demonstrating that judging whether the *literal* meaning of a metaphor was true or false required a longer response time than judging the literal meaning of a non-metaphor control sentence; a phenomenon they termed the metaphor interference effect (MIE).

1.1.1.1. The metaphor interference effect. Glucksberg et al. (1982) asked participants to read sentences and judge whether each was literally true or false. There were four sentence types, all of the form, "Some *x* are *y*": (a) literally true (LT) sentences, where *x* was a category name, such as "trees" and *y* was a common exemplar of that category such as "oaks" (e.g., "Some trees are oaks", "Some experts are nurses"); (b) literally false (LF) sentences, which were constructed by scrambling the literally true sentences (e.g., "Some experts are oaks", "Some trees are nurses"); (c) metaphors (M), which were novel, but readily interpretable in a nonliteral sense (e.g., "Some roads are ribbons", "Some cats are princesses"); and (d) scrambled metaphors (SM), which were constructed by scrambling the lexical items from the metaphor sentences (e.g., "Some roads are princesses", "Some cats are ribbons") and were not readily interpretable. If processing was simultaneous, then literally true, literally false, and scrambled metaphor sentences, which only have literal interpretations, would not incur any interference with the task requirement of judging the literal meaning. However, for metaphors, the simultaneous presence of both the metaphorically true and literally false meanings would create momentary processing interference (i.e., the MIE), which would need to be resolved before the false literal meaning could be isolated and judged. This would result in increased response times for metaphors compared to control sentences (Glucksberg et al., 1982). If the serial model were true, then for all four sentence types, the literal interpretation would be the first meaning available, resulting in similar response times for all "false" sentence types, including metaphors. Glucksberg et al. (1982) determined the presence of the MIE (i.e., metaphors required longer than control "false" sentences) and concluded that integration entailed automatic and simultaneous generation of the literal and nonliteral meanings.

1.2. Stages of processing in ASD

1.2.1. Access

The earliest stage of metaphor comprehension requires accessing the relevant information for all the words in the utterance. Studies comparing semantic knowledge skills in individuals with and without ASD have found that children with ASD and VIQs >70, matched with control children based on reading speed, were as quick and as accurate as controls at accessing word meanings and underlying conceptual structures (Eskes, Bryson, & McCormick, 1990); that children with ASD