**How do Theory of Mind and understanding social situations contribute to idiom and irony comprehension?**

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**Abstract**

Figurative language is a central tool for enriching spoken and written language that enhances the development of a high linguistic level among skilled speakers. Studies have found gaps in the understanding of figurative language among children with autism spectrum disorder (ASD) compared to their peers with typical development (TD). A core difficulty among children with ASD is associated with deficits in the understanding of social situations. However, no studies to date have been examined the relationship between the ability to understand social situations (as a separate ability) and the ability to understand irony and idioms. This study included 58 participants aged 8–11, including 28 children with high-functioning ASD, and 30 children with TD matched by age, gender, and nonverbal intelligence. All participants completed Theory of Mind (ToM) questionnaires to assess their understanding of the other’s intentions, as well as questionnaires pertaining to their comprehension of social situations, irony, and idioms. We hypothesized that: (1) children with TD would outperform the ASD group in their understanding of irony, idioms, ToM, and social situations; (2) positive relationships would be observed between understanding social situations and understanding idioms and irony; and (3) understanding of social situations and ToM ability would predict irony and idiom comprehension. The results ultimately confirmed the first hypothesis, as we observed positive correlations between understanding of social situations and understanding of idioms and irony in each group. However, after controlling for vocabulary, these associations were attenuated. Ultimately, vocabulary was found to play a central role in predicting the understanding of idioms and irony. Together, understanding social situations and ToM also predicted idiom and irony understanding, with ToM ability also uniquely contributing to irony understanding. Thus, the present study demonstrates that the factors that contribute to predicting the understanding of irony and idioms include vocabulary, understanding the other’s intentions, and understanding social situations. ToM contributes more substantially to irony comprehension, supporting the role of social factors in the understanding of irony in particular.

**Introduction**

Figurative language serves as a central tool for enriching social interactions and written language. The use of figurative language is prevalent in all types of discourse, including social conversations, blogs, and emails (Tannen, 2005; Whalen et al., 2013). The different aspects of figurative language, including, for example, metaphors, humor, irony, and idioms, are characterized by a gap between the literal meaning of the figurative expression and the message the speaker intends to convey (Glucksberg & McGlone, 2001). Figurative language thus contravenes Grice’s maxim of quality, which states that the speaker should convey to the listener precise, true, and verifiable information (Grice, 1975). The ability to understand all types of figurative language is thus dependent on the listener’s ability to think beyond the literal meaning, retrieve the figurative interpretation from their mental lexicon, or compute the expression’s meaning and adjust it to the context (Berman & Ravid, 2010; Bernstein, 1987; Rapp & Wild, 2011). Consequently, difficulties in figurative language understanding may negatively affect educational achievements (Swineford et al., 2014) and social interactions, thereby potentially resulting in social exclusion and misunderstandings (e.g., Kim & Lantolf, 2018).

Two common types of figurative language are idioms and irony. Idioms are defined as a combination of at least two words whose meaning is not derived from a direct literal interpretation, but is one that creates a new meaning (Roberts & Kruez, 1994; Swinney & Cutler, 1979). Idioms are considerably fixed, lexicalized figurative phrases that, according to the Global Elaboration Hypothesis (Levorato & Cacciari, 1995), develop along with users’ general linguistic and cognitive development. Idioms vary in several dimensions, such as the level of familiarity, transparency (the extent to which the meaning of the individual words contributes to the figurative meaning), and literal plausibility (the extent to which the literal meaning is plausible). Studies have shown that these dimensions affect listeners’ ability to understand idioms throughout life (Titone & Connine, 1994). For example, 5-year-old children find it easier to understand transparent idioms than opaque ones(Gibbs, 1991). Nine-year-old children are able to rely on the transparency of an idiom to understand its meaning out of context, but 7-year-olds are not ([Levorato & Cacciari, 1999)](https://www.sciencedirect.com/science/article/pii/S0022096508001173?casa_token=gsOtanLhRpwAAAAA:yc7UocrA52Tqpm54nxKL3Ho-HrBdi0uOMlrv4pDj1wNAsoHj_nYDbYFLC8fEKHeYjaX_hIeSxQ" \l "bib15). Fourteen-year-old adolescents outperformed 11-year-old children in explaining the meaning of transparent idioms ([Nippold & Taylor, 1995](https://www.sciencedirect.com/science/article/pii/S0022096508001173?casa_token=gsOtanLhRpwAAAAA:yc7UocrA52Tqpm54nxKL3Ho-HrBdi0uOMlrv4pDj1wNAsoHj_nYDbYFLC8fEKHeYjaX_hIeSxQ" \l "bib20)), attesting to the contribution of age to the development of idiom understanding (Saban-Bezalel & Mashal, 2019). Irony refers to conveying a message by using a critical, skeptical, or even mocking approach (Wilson & Sperber, 2012). Among the various types of figurative language, irony is one of the most challenging to acquire (Ackerman, [1982](https://www.mdpi.com/2226-471X/4/2/23%22%20%5Cl%20%22B1-languages-04-00023)). Children begin to understand irony around the age of 5–6-years-old (Dews & Winner, 1997; Harris & Pexman, 2003), and continue to develop this ability through middle childhood, between approximately 7–10-years-old (Bosco & Bucciarelli, 2008; Filippova & Astington, 2008). Nonethless, evidence suggests that irony comprehension continues to develop into adolescence (Demorest et al., 1984; Glenwright et al., 2017). The current study seeks to focus on children aged 8–11-years-old, an age range in which the understanding of figurative language is still developing and has not yet reached its peak (Cain et al., 2009).

Core deficits in individuals with autism spectrum disorder (ASD) involve social and communicative impairments that include decreased understanding of figurative language compared to individuals with typical development (TD) (Chahboun et al., 2021; Norbury, 2004; Saban-Bezalel & Mashal, 2015, 2019; Vulchanova et al., 2015) and a tendency to interpret such language literally (Mackay & Shaw, 2004; Mashal and Kasirer, 2011; Satkoske et al., 2019). For example, using multiple-choice questionnaires, Mashal and Kasirer (2011) observed decreased idiom and metaphor understanding in children with ASD compared to their peers with TD. In a study that examined the hemispheric processing of figurative language, adults with ASD exhibited a reduced understanding of irony and idioms compared to their peers with TD matched for age, nonverbal intelligence, and vocabulary (Saban-Bezalel & Mashal, 2015). Reduced understanding of idioms and humor was also observed in adolescents with ASD aged 12-15-years-old as compared to their peers with TD of matched by age, gender, and vocabulary knowledge (Yankovitz et al., 2023). Similarly, findings from a recent study with adolescents aged 10-15-years-old also revealed reduced irony understanding among adolescents with ASD relative to their peers with TD of matched fo age, gender, vocabulary, and EFs, with similar results in a second-order false-belief task (Saban-Bezalel & Mashal, 2019). However, there is evidence demonstrating that there is no difference between children with ASD and TD children in the ability to understand figurative language (Abrahamsen & Smith, 2000; Mackay & Shaw, 2004; Morsanyi & Stamenkovic, 2021; Rundblad & Annaz, 2010). Another study showed that among young children with ASD (5–12-years-old), idiom comprehension abilities did not differ from those of children with TD matched on age and syntactic ability (Whyte et al., 2014). Thus, although most of the studies have reported difficulties in understanding idioms and irony among children with ASD, the findings remain inconclusive.

Various theories and models have been proposed to explain the difficulties in figurative language understanding exhibited in individuals with ASD. One of the main theories, the Theory of Mind (ToM), pertains to the core difficulties associated with ASD, namely impaired social communication and interaction (Baron-Cohen et al., 2001; Livingston et al., 2018). According to this theory, people diagnosed with ASD have difficulty understanding the mental state of others. As a result, they are prone to suffer from a deficient understanding of social situations and communication directed towards them. In this context, ToM ability predicts pragmatic understanding (Cummings, 2013) and, more specifically, figurative language processing among children and adults with ASD (Happé, 1995). Evidence suggests that this association between ToM abilities and the ability to understand idioms is evident among children with ASD, but not among children with TD (Whyte et al., 2014). Furthermore, it has been suggested that first-order ToM ability is sufficient for understanding metaphors, but not for understanding irony, whereas second-order ToM ability contributes to the understanding of metaphors and irony. The role of ToM ability in irony comprehension was also examined in a recent study (Saban-Bezalel et al., 2019), in which participants with TD outperformed the group with ASD in irony comprehension. However, when participants were matched for ToM ability (as assessed by the Hinting test) both groups exhibited similar performance in the irony comprehension task. These findings highlight the link between ToM ability and the understanding of idioms and irony among individuals with ASD.

Other researchers attribute challenges individuals with ASD experience in understanding figurative language to the difficulty they experience in performing executive functions. Limited mental flexibility can impair the shift between the literal and the non-literal interpretations of a figurative expression (Cummings, 2013; Landa & Goldberg 2005). Evidence from previous studies indicates that participants with ASD scored lower on figurative language tasks (Berman & Ravid, 2010; Chahboun et al., 2021; Norbury, 2004) and in most tasks involving executive functions than did their peers with TD. Mashal and Kasirer’s (2011) study found that children with TD outperformed their ASD peers matched in age and vocabulary in tasks involving idiom and metaphor understanding. In that study, children with ASD also showed lower performance in tasks involving executive functions based on language. However, the correlation between EF and idiom comprehension was not tested in any of these studies. Furthermore, when the relationship between executive functions and figurative language understanding was examined, no significant relationship was found (Landa & Goldberg, 2005). Thus, the contribution of EFs to idiom and irony comprehension remains unclear.

Another approach to explaining the difficulties in understanding figurative language among individuals with ASD is based on acknowledging their general difficulty in understanding language (Gernsbacher & Pripas-Kapit, 2012). Supporting this approach, a recent meta-analysis (Kalandadze et al., 2018) found that when the participants were matched according to their language abilities, and especially according to vocabulary and syntactic capabilities, no significant differences were observed in figurative language understanding between the groups with ASD and with TD. The unique contribution of vocabulary to idiom comprehension performance among individuals with ASD was demonstrated in a recent study that showed that vocabulary contributed significantly to idiom comprehension performance, beyond the contributions of age and gender among participants with ASD, but did not do so among their TD peers (Saban-Bezalel & Mashal, 2019). Furthermore, previous studies have shown that general language comprehension abilities were more strongly related to the ability to understand ambiguous ideas than to the ASD characteristics of the study participants (Giora et al., 2012).

An additional important factor in children’s developmental progress that may influence their comprehension of irony involves understanding social situations. ToM ability includes several skills, such as mindreading and empathy, necessary for manaing social communication and relationships (Korkmaz, 2011). Children with a more developed capacity to discern the emotions and feelings of others may exhibit higher irony comprehension. Indeed, it has been shown that irony comprehension is associated with empathy skills (Nicholson et al., 2013). Consequently, impaired ToM ability in ASD may coincide with deficient empathy, thereby impairing irony comprehension.

The ability to understand social situations is a central issue in the study of ASD. This ability includes the understanding of social cues, social vigilance, and executive social abilities (Carreras et al., 2014; Ford & Tisak, 1983). Evidence suggests that participants with ASD experience difficulty judging social appropriateness in situations viewed in video format (Loveland et al., 2001), and that their explanations about comics portraying events involving social inappropriateness are generally unusual and inappropriate (Nah & Poon, 2011). One of the accepted models for explaining the understanding of both social situations and the intentions and needs of others is the social information processing (SIP) model (Dowswell & Chessor, 2014). According to the SIP model, to behave appropriately and effectively in everyday situations, an individual needs to process social information effectively, perceive and interpret social cues accurately, understand the goals, intentions, and needs of the other in the context of the social situation, and, finally, use all this knowledge to behave appropriately (Carreras et al., 2014). Evidence suggests a link between ToM ability (as assessed by a false-belief understanding task), EFs, and understanding of social situations (Razza & Blair, 2009). As the DSM-5 (APA, 2013) indicates, individuals with ASD exhibit difficulties in social understanding, appropriate use of gestures and social skills, maintaining friendships, engaging in social play, and making inferences about social scripts (Bauminger-Zviely, 2013; Dennis et al., 2001; Macintosh & Dissanayake, 2006). These difficulties may negatively affect social interactions (Bauminger-Zviely, 2013; Chung et al., 2007). Using a questionnaire focused on their understanding of social situations, the current study seeks to assess social understanding among school children with ASD and among TD children while also examining, for the first time, the link between social understanding and idiom and irony comprehension. There appears to be a common denominator underlying the understanding of social situations and figurative language: processing social information demands the ability to perceive, remember, and interpret social contexts using cues, and to understand the intentions of the other (Dennis et al., 2001). These abilities, at least in part, are also required for processing idioms and irony.

The overarching goal of the present study was to examine the relationship between the ability to understand social situations and the ability to understand irony and idioms. Figurative language is important for proper social functioning and for creating and establishing social relationships (Swineford et al., 2014), but the direct relationship between them has not yet been tested. The aims of the present study are thus threefold: 1) to examine the understanding of idioms, irony, and social situations in children with ASD compared to children with TD; 2) to examine the relationship between understanding social situations and understanding idioms and irony in each groupseparately; and 3) to examine what abilities contribute to the understanding of irony and idioms, with a specific focus on the contributions of vocabulary, ToM, and social situation comprehension. We hypothesized that children with TD would outperform the ASD group in terms of their comprehension of idioms, irony, and social situations (Bauminger-Zviely, 2013; Berman & Ravid, 2010; Chahboun et al., 2021; Dennis et al., 2001; Mashal and Kasirer, 2011; Norbury, 2004; Saban-Bezalel & Mashal, 2015, 2019; Vulchanova et al., 2015). We also hypothesized that understanding idioms and irony is linked to understanding social situations, as both abilities entail, at least in part, the understanding of the intentions of the other (thus requiring proper ToM functioning) and executive function (Razza & Blair, 2009). Finally, we hypothesized that vocabulary and the understanding of both social situations and ToM ability would contribute to the explained variance of idiom and irony understanding. Unlike idiomatic expressions, ironic expressions depend more heavily on understanding the social context and the speaker’s intention, and we thus presumed that vocabulary (Saban-Bezalel et al., 2019), understanding social situations, and ToM ability would all contribute to irony comprehension (Razza & Blair, 2009).

**Methods**

**Participants**

In total, 58 participants aged 8–11, in grades 3–6, including 28 children with ASD and 30 children with TD, participated in the study. The participants with ASD were diagnosed by psychologists or psychiatrists according to the DSM-5 criteria. The clinical diagnosis of these participants was confirmed using the Social Communication Questionnaire (SCQ ). The participants were recruited from communication classes in a mainstream education school in the south of the country. The participants in the control group exhibited typical development, without self-reported neurodevelopmental disorders or psychiatric diagnoses. Control participants were recruited through relatives, acquaintances, and friends. Table 1 shows the background characteristics of both groups.

**\*\* insert Table 1 about here \*\*\***

**Table 1**: *Participant demographic and background characteristics*

As shown in Table 1, no significant difference was found between the groups in terms of age, gender, or nonverbal intelligence. However, children with TD scored higher on vocabulary than did their ASD peers.

**Materials**

***Verbal and Nonverbal Intelligence Tests***

*Vocabulary* was assessed using the vocabulary subtest from the Wechsler Intelligent Scale for children (Wechsler Intelligent Scale WISC-IVHEB). Wechsler developed this test to measure the cognitive ability of children aged 6–16-years-old (Wechsler, 2003), and the test was translated and adopted in Israel by Lieblich et al. (1976). The reliability coefficients for verbal IQ, executive IQ, and general ability were 95, 92, and 96, respectively. Retest reliability was over 90. In the present study, a vocabulary subtest was used, which serves as one of the most salient indicators of verbal ability. The test measured the quality of the particpant’s language and ability to learn, the particpant’s basic vocabulary database, and their understanding of the meaning of words and ideas. The test included 35 items with a maximum raw score of 70 points.

*Nonverbal intelligence* was assessed using the RAVEN test (CPM Raven’s Colored Progressive Matrices) (Raven et al., 2003). The test included 36 items divided into 3 sets, with 12 items in each set. The items were arranged in order of increasing difficulty, as were the three sets in the test. For each item, the subject had to choose the missing part that completed the picture shown to them. There was one correct answer out of six options. Correct and incorrect answers received scores of 1 and 0, respectively, with a maximum score of 36. The test was suitable for ages 5 and up. Test reliability ranged between r = 0.81 and r = 0.94, according to various studies, and test-retest reliability was over r = 0.80 (Raven et al., 2003).

***Validation of ASD Diagnoses and ToM Assessment***

*The SCQ* was used to validate the ASD diagnosis of the subjects in the research group. The parents of children with ASD answered the SCQ (Rutter et al., 2003), which is a parental report questionnaire designed to determine whether their child falls within the autism spectrum. The results from this tool were correlated with those from the ADI diagnostic questionnaire (Lord et al., 1994) (r = 0.71). The SCQ included 40 items related to the areas of communication, mutual social communication, interests, and repetitive and stereotypical activities. The results of the questionnaire were summarized and rated on a scale from 0–33 for nonverbal children or 0–39 for verbal children. A score above 15 confirmed a diagnosis of ASD, while a score above 22 provided a classification of ASD. The questionnaire was found to exhibit good diagnostic validity, with a sensitivity to diagnose ASD of 0.85 and a specificity of 0.75.

*The Hinting test* (Corcoran et al, Mercer & Frith , 1995) evaluates the understanding of the other’s intentions, and was tested in patients with schizophrenia and children with ASD (Pilowsky et al., 2000). The test was previously translated into Hebrew and used in a study of children and adolescents with ASD (Saban-Bezalel et al., 2019). For this study, the participant was presented with 10 short stories describing a situation involving two characters. At the end of each story, a question was posed related to the understanding of the speaker’s intention, which was not explicitly stated in the story. For example: “Karen’s birthday is coming up. Karen says to her father, ‘I love animals, especially dogs.’ Question: ‘What does Karen really mean when she says that?’” If the subject answered incorrectly, a hint is provided: “Dad, will the pet store be open on my birthday?” A correct answer was awarded two points. The maximum score for this test was 2 points. If the participant initially answered incorrectly but was able to answer correctly using the hint, 1 point was awarded.

***Figurative Language Questionnaires***

*The idiom questionnaire* (Mashal & Kasirer, 2011) tests the ability to understand idioms. This questionnaire is a multiple-choice test that consists of 20 idioms. In this study, for each idiom, four choices were presented: 1) the correct answer; 2) an incorrect literal answer; 3) another literal distractor; and 4) an unrelated answer. The proposed options were displayed in a random order. The participant was required to select the answer closest to the meaning of the entire sentence. For example, for the idiom “sprinkling salt on the wounds,” four alternatives were presented: A) spice spreader; B) disinfecting the warts; C) talking about other people's failures and thereby causing them additional pain; and D) listening to others. Participants received one point for each correct answer.

*The irony comprehension questionnaire* (Saban-Bezalel & Mashal, 2015) included 15 items, of which 10 included short text passages with ironic meaning and the remaining 5 included short passages with literal meaning. The sections in the questionnaire were presented in a random order. The subject were asked to read each passage and answer an open-ended question that refered to the intention or thought of the speaker. For example: “The final exam lasted for about three hours, covered a lot of material, and included material that was not studied at all. At the end of the test, the students said to the teacher: ‘The test was easy.’ What did the students think about the test?” Participants received one point for a correct answer with a maximum of 10 points for the ironic portion and 5 points for the literal portion. The score was converted to percentages.

***Social Understanding***

*The Children’s Social Comprehension Scale (CSCS*) (Knopp, 2019) is a social comprehension scale questionnaire for children aged 6–11-years-old. The questionnaire assesses the ability to encode social information, as well as the respondent’s understanding and interpretation of human behavior in social situations. The questionnaire is used to measure the cognitive component of social ability among young school-aged children (Fig. 1), given that knowledge is required regarding social norms, the principles behind them, the consequences of violating these norms, and related topics.

The questionnaire in this study included 10 items consisting of short stories accompanied by pictures (an example will be given below). Each item described a problematic social situation. The participant was required to decide what was the worst thing in the specific situation. The stories referred to diverse social situations, such as gossip, bullying, violating privacy laws, and not sharing with a friend. The question presented at the end of each story was a multiple-choice question with four possible answers, one of which is correct. Participants scored one point for a correct answer and zero points for a wrong answer. The maximum possible score was 10 points. Cronbach’s alpha test reliability coefficient values for the CSCS were 0.68 for ages 6–7, 0.75 for ages 8–9, and 0.89 for ages 10–11. The validity of the test, according to the confirmatory fit index (CFI) was above 0.95.

**\*\*\* Fig 1 about here \*\*\***

**Procedure**

The participants and their parents signed a consent form that was approved by the chief scientist of the Ministry of Education and the ethics committee of Bar-Ilan University. Parents were provided with an explanation of the purpose of the study and the manner of its execution. At the beginning of the meeting, the participants received a general explanation of the study and answered the questionnaires individually. Each participant completed the tests in a quiet room in the participant’s home or at the school during one session that lasted 60–90 minutes. The SCQ questionnaire was delivered electronically program to the parents of the ASD participants using the Google Forms. The rest of the questionnaires were delivered orally by the researcher, who recorded the responses in written form. The tests were administered in a random order to exclude possible effects between the tests.

**Data Analysis**

To examine differences between groups in the understanding of idioms, irony, social situations, and ToM, a one-way multivariate analysis of variance (MANCOVA) controlling for vocabulary was conducted. Pearson correlations were used to examine the relationships between understanding social situations and understanding idioms and irony in each groupseparately. To test to what extent understanding social situations and ToM abilities contribute to understanding irony or idioms (as dependent variables), a hierarchical regression analysis was performed for each group separately.

**Results**

**Comparing Idiom, Irony, and Social Understanding Between Groups**

To test group differences, a one-way MANCOVA analysis was conducted including idiom, irony, ToM (Hinting test), and understanding of social situations (CSCS) as dependent variables, group (TD, ASD) as the independent variable, and vocabulary as the controlled variable. Table 2 shows the means, standard deviations, standardized means, and the results of the MANCOVA.

This analysis revealed a significant difference between the groups at the multivariate level (F (4,52) = 18.16, p < 0.001, $η\_{p}^{2}$ = 0.583). Post-hoc ANOVAs were conducted to test group differences for each variable separately (Table 2). As shown in Table 2, significant differences were found in all variables. Thus, consistent with our first hypothesis, children with TD outperformed the ASD group in terms of their understanding of idioms, irony, ToM, and social situations ( Fig. 2).

**Table 2:** *Means, standard deviations, and one-way MANCOVA analysis findings when examining differences in understanding of idioms, irony, and social situations among groups (N=58)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | ASD |  | TD |  |
| *F (1,55)* | $$η\_{p}^{2}$$ | *SD* | *M* |  | *SD* | *M* |  |
| 6.78\* | .110 | 3.90 | 10.57 |  | 2.96 | 17.33 | Idiom |
| \*\*\*64.58 | .540 | 2.57 | 6.64 |  | 1.69 | 13.87 | Irony |
| \*\*\*15.72 | 222. | 1.57 | 4.54 |  | 1.76 | 8.30 | Social situation |
| \*\*\*39.99 | 421. | 3.52 | 10.68 |  | 1.97 | 18.70 | ToM |
|  |  |

**\*\*\* Insert Fig 2 about here \*\*\***

**Figure 2:** *Adjusted means for idioms, irony, and social situation understanding and ToM (N=58)*

***Table 3****: Pearson and partial Pearson correlations controlled for vocabulary*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **TYP** |  | **ASD** |  |
|  | **Idiom** | **Irony** |  | **Idiom** | **Irony** |  |
|  | \*\*\*81. | \*\*\*69. |  | \*\*\*68. | \*\*\*72. | CSCS |
|  | .43\* | .35\* |  | 20. | .74\*\*\* | CSCSpartial |
|  |

To test the relationships between understanding social situations and the comprehension of idioms and irony, correlations and partial correlations (controlling for vocabulary) were computed in each group separately. As shown in Table 3, the Pearson correlation coefficients in each group were significant and positive. This is consistent with our second hypothesis, and suggests that a greater understanding of social situations is associated with a greater understanding of both idioms and irony (Fig. 3). These correlations were attenuated when controlling for vocabulary, although they remained significant with the exception of the correlation between social situation understanding and idiom comprehension in the ASD group.

**The Contributions of Demographic and Background Variables, Understanding Social Situations, and Group Affiliation to Idiom and Irony Comprehension**

Two hierarchical regression models were applied, with one being used to predict irony comprehension while the other was used to predict idiom comprehension. In each model, in the first step, age and gender were entered as controlled variables. In the second step, vocabulary as well as nonverbal intelligence were entered. In the third step, group affiliation, understanding of social situations, and ToM (centered), were entered. In the fourth step, the interaction factors for interactions between group and understanding of social situations and ToM were entered (Table 4).

As shown in Table 4, the first step was not significant in either model, with 1.9% and 4.8% explained variance (EPV) for the idiom and irony models, respectively. The second step, in which the vocabulary and nonverbal intelligence were entered, was significant for both models with increases in EPV of 81.0% and 57.3% for the idiom and irony models, respectively. Further examination of the coefficients revealed that for both models, only vocabulary had a significant unique contribution, with higher verbal intelligence predicting a better understanding of idioms and irony. In the third step, group affiliation, understanding social situations, and ToM were found to contribute significantly in both models, with 2.8% and 32.1% respective increases in EPV. An examination of the associated coefficients revealed that none of the variables significantly predicted idiom comprehension, although the entire step was significant. In the irony understanding model, a significant unique contribution was found for both the group affiliation and ToM. The fourth step did not yield any significant contributions for the idiom or irony models, with 0.00% and 0.2% respective increases in EPV. This result indicates that the relationships found in the third step did not differ between the two groups.

**Discussion**

This study’s findings suggest that participants with TD scored higher in their understanding of idioms, irony, ToM, and social situations compared to participants with ASD, matched according to age, gender, and nonverbal intelligence. These results reinforce previous studies that compared figurative language and social competence between children with TD and children with ASD (Berman & Ravid, 2010; Dennis et al., 2001; Mashal & Kasirer, 2011; Norbury, 2004; Saban-Bezalel & Mashal, 2015; 2019; Vulchanova et al., 2015). These findings highlight a gap in idiom and irony comprehension in children with ASD compared to children with TD aged from 8–11-years-old, an age range in which these aspects of figurative language have matured but are still developing.

Our second hypothesis speculated that a positive relationship would be detected between the ability to understand social situations and the ability to understand idioms and irony. However, social situation understanding and figurative language comprehension originate in different domains, with the former stemming from social cognition and the latter from figurative language processing. Figurative language, as an aspect of the broader domain of understanding language in a social context, namely pragmatics, is closely related to ToM ability (Bosco et al., 2018; Cummings, 2013), and ToM ability is linked to an understanding of social situations (Razza & Blair, 2009). To succeed in a social understanding task, participants must encode the provided social information, interpret social information, such as cues, identify violations of behavioral norms (e.g., violating a teacher’s privacy by rummaging through the teacher’s bag), and understand the associated consequences, while also understanding the beliefs and intentions of the other. Consequently, there appear to be shared abilities underlying these two apparently remote areas investigated in the current study. Our results therefore demonstrate that the better an individual’s understanding of social situations, the greater their understanding of figurative language (idioms and irony).

Nevertheless, vocabulary seems to play an important role in shaping understanding of figurative language and social situations. When controlling for vocabulary, the detected correlations were attenuated in each group. Whereas the partial correlations between understanding social situations and figurative language remained significant among the participants with TD, the correlation between understanding social situations and idiom comprehension among children with ASD was not signficant. This finding correleates with the results obtained from the hierarchical regression analysis. When verbal and nonverbal intelligence scores were entered in the second step of the model, vocabulary (but not nonverbal intelligence) exhibited a significant unique contribution to idiom comprehension. In particular, 81% and 57% increases in the EPVs for idiom and irony comprehension, respectively, were observed. Thus, consistent with Saban-Bezalel et al.’s previous study (2019), higher levels of vocabulary knowledge were associated with a better understanding of idioms and irony.

Our third hypothesis focused on the contributions of ToM and understanding social situations to irony and idiom comprehension. The current results indicated that group affiliation, understanding social situations, and understanding the other’s intentions contributed to both the idiom and irony comprehension models. However, none of these variables were individually able to significantly predict idiom comprehension, despite the significant predictive performance of the overall step. In contrast, for irony comprehension, a significant unique contribution was observed for both group affiliation and ToM, but not social situation understanding. In other words, being a child with TD and thus enjoying a greater ability to understand the other’s intentions contributes to a better understanding of irony. This finding attests to the differential characteristics of the ironic stimuli, which involve understanding social scenarios in contrast to the idioms, which were provided without context.

There are several limitations to this study that should be noted. The first involves the difference in vocabulary knowledge between groups. Although the children with ASD were high-functioning and recruited from communication classes in mainstream schools, they nonetheless demonstrated lower vocabulary knowledge than the children with TD. Despite controlling for vocabulary in our statistical analyses, these results are limited to children with TD matched to children with ASD by chronological age and nonverbal intelligence. Another limitation of this study concerns the questionnaires that were used. A deeper inspection of these questionnaires may explain the differential results obtained for the idiom and the irony models. For example, our findings show that vocabulary plays an important role in the understanding of idioms and irony among children with and without ASD, beyond the effects of age and gender. Social abilities, including understanding the intentions of the other (ToM) and the ability to understand social situations, further increase their comprehension. However, ToM ability was found to uniquely contribute to irony but not to idiom comprehension. This difference is likely attributable to the type of questionnaire used: the ironic stimuli were embedded within social situations whereas idioms were presented with no context. Our results also indicated that ToM ability but not performance on the social understanding questionnaire (CSCS) uniquely contributed to the understanding of irony. The CSCS, unlike the Hinting test, requires social knowledge in order to identify violations of social norms, thus contributing less to participant performance when evaluating the ironic scenarios compared to the Hinting test. These findings strengthen the need to conduct future studies that use various methods to assess social situation understanding (e.g., observations or interviews).

In conclusion, vocabulary plays a major role in the understanding of idioms and irony among children with ASD and their age-matched TD peers. This finding supports the model that posits that difficulties in figurative language understanding among individuals with ASD is consistent with a general difficulty in understanding language among these individuals (Gernsbacher & Pripas-Kapit, 2012), as our cohort with ASD scored lower on the vocabulary test compared to the group with TD. However, other studies using groups balanced for age and vocabulary have reported poorer performance in figurative understanding tasks among participants with ASD compared to controls. Our findings also highlight the contributions of ToM ability and social situation understanding to the comprehension of both irony and idioms, although the ability to understand the intentions of others uniquely predicted understanding of irony (beyond vocabulary) but not idioms. These findings support the ToM model that explains pragmatic difficulties in ASD (Baron-Cohen et al., 2001; Livingston et al., 2018). Intervention programs aiming to enhance figurative language comprehension should consider using these social abilities to enhance the programs’ efficiency in promoting greater irony and idiom comprehension among children and adolescents with ASD.

**Replication Package**

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**Author Contributions**

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**Competing Interests**

**References**

Abrahamsen, E. P., & Smith, R. (2000). Facilitating idiom acquisition in children with communication disorders: computer vs classroom.*Child Language Teaching and Therapy,* 16(3), 227–239.‏

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians.*Journal of Autism and Developmental Disorders,*31(1), 5–17.‏

Bauminger-Zviely, N. (2013). Social and academic abilities in high-functioning autism spectrum disorders.‏ New York: Guilford Press. Chapter 4 – Development (pp 88–109).

Berman, R. A., & Ravid, D. (2010). Interpretation and recall of proverbs in three school-age populations. *First Language*, 30(2), 155–173.‏

Bernstein, D. K. (1987). Figurative language: assessment strategies and implications for intervention. *Folia Phoniatrica et Logopaedica*, 39(3), 130–144.‏

Bosco, F.M., & Bucciarelli, M. (2008). Simple and complex deceits and ironies. *Journal of Pragmatics*, 40, 583–607.

Bosco, F. M., Tirassa, M., & Gabbatore, I. (2018). Why pragmatics and Theory of Mind do not (completely) overlap. *Frontiers in Psychology*, 9, 1453.‏

Cain, K., Towse, A.S., & Knight, R.S. (2009). The development of idiom comprehension: An investigation of semantic and contextual processing skills. *Journal of Experimental Child Psychology*, 102 (3), 280–298.

Carreras, M. R., Braza, P., Muñoz, J. M., Braza, F., Azurmendi, A., Pascual‐Sagastizabal, E., ... & Sánchez‐Martín, J. R. (2014). Aggression and prosocial behaviors in social conflicts mediating the influence of cold social intelligence and affective empathy on children's social preference. *Scandinavian Journal of Psychology*, 55(4), 371–379.‏

Chahboun, S., Vulchanov, V., Saldaña, D., Eshuis, H., & Vulchanova, M. (2016). Can you play with fire and not hurt yourself? A comparative study in figurative language comprehension between individuals with and without autism spectrum disorder. *PloS One,* 11(12), e0168571.‏

Chung, K. M., Reavis, S., Mosconi, M., Drewry, J., Matthews, T., & Tassé, M. J. (2007). Peer-mediated social skills training program for young children with high-functioning autism. *Research in Developmental Disabilities*, 28(4), 423–436.‏

Cooper, T. C. (1999). Processing of idioms by L2 learners of English. *TESOL quarterly*, 33(2), 233–262.‏

Corcoran, R., Mercer, G., & Frith, C. D. (1995). Schizophrenia, symptomatology and social inference: investigating “theory of mind” in people with schizophrenia. *Schizophrenia Research,* 17(1), 5–13.‏

Demorest, A., Meyer, C., Phelps, E., Gardner, H., Winner, E. (1984). Words speak louder than actions: Understanding deliberately false remarks*. Child Development*, 55, 1527–1534.

Dews, S., & Winner, E. (1997). Attributing meaning to deliberately false utterances: The case of irony. In Advances in Psychology (Vol. 122, pp. 377–414). North-Holland.‏

Dowswell, E., & Chessor, D. (2014). Socially skilled-successful students: Improving children's social intelligence through social education programs. *e-Journal of Social & Behavioural Research in Business,* 5(2), 23.‏

Edition, F. (2013). Diagnostic and statistical manual of mental disorders. Am Psychiatric Assoc, 21.‏

Elison, J. T., Sasson, N. J., Turner-Brown, L. M., Dichter, G. S., & Bodfish, J. W. (2012). Age trends in visual exploration of social and nonsocial information in children with autism. *Research in autism spectrum disorders*, 6(2), 842–851.‏

Filippova, E., & Astington, J. W. (2008). Further development in social reasoning revealed in discourse irony understanding. *Child Development*, 79(1), 126–138.‏

Ford, M. E., & Tisak, M. S. (1983). A further search for social intelligence. *Journal of Educational Psychology*, 75(2), 196.‏

Frith, C. D., & Frith, U. (2008). Implicit and explicit processes in social cognition. *Neuron*, 60(3), 503–510.‏

Frith, U. (1994). Autism and theory of mind in everyday life. *Social Development*, 3(2), 108-124.‏

Gallagher, T. M. (1993). Language skill and the development of social competence in school-age children. *Language, Speech, and Hearing Services in Schools*, 24(4), 199–205.‏

Gernsbacher, M. A., & Pripas-Kapit, S. R. (2012). Who's missing the point? A commentary on claims that autistic persons have a specific deficit in figurative language comprehension. *Metaphor and Symbol*, 27(1), 93–105.‏

Glenwright, M., Brent, T., Rano, J.K.S., & Pexman, P.M. (2017). Developing appreciation for sarcasm and sarcastic gossip: It depends on perspective. *Journal of Speech, Language, and Hearing Research,* 60, 3295–3309

Giora, R., Gazal, O., Goldstein, I., Fein, O., & Stringaris, A. (2012). Salience and context: Interpretation of metaphorical and literal language by young adults diagnosed with Asperger's syndrome. *Metaphor and Symbol*, 27(1), 22–54.‏

Glucksberg, S., & McGlone, M. S. (2001). Understanding figurative language: From metaphor to idioms (No. 36). Oxford University Press on Demand.‏

Grice, H. P. (1975). Speech acts. *Syntax and Semantics*, 3, 41–58.‏

Harris, M., & Pexman, P.M. (2003). Children’s perceptions of the social functions of verbal irony. *Discourse Processes,* 36, 147–165.

Happé, F. G. (1995). Understanding minds and metaphors: Insights from the study of figurative language in autism. *Metaphor and Symbol,*10(4), 275–295.‏

Kalandadze, T., Norbury, C., Nærland, T., & Næss, K. A. B. (2018). Figurative language comprehension in individuals with autism spectrum disorder: A meta-analytic review. *Autism*, 22(2), 99–117.‏

Kasirer, A., & Mashal, N. (2016). Comprehension and generation of metaphors by children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, 32, 53–63.

Kasirer, A., Adi-Japha, E., & Mashal, N. (2020). Verbal and figural creativity in children with autism spectrum disorder and typical development*. Frontiers in Psychology*, 11, 559238.‏

Kerbel, D., & Grunwell, P. (1997). Idioms in the classroom: An investigation of language unit and mainstream teachers’ use of idioms. *Child Language Teaching and Therapy*, 13(2), 113–123.‏

Korkmaz, B. (2011). Theory of Mind and Neurodevelopmental Disorders of Childhood. *Pediatric Research*, 69, 101–108.

Knopp, K. A. (2019). The Children’s Social Comprehension Scale (CSCS): Construct validity of a new social intelligence measure for elementary school children. *International Journal of Behavioral Development,* 43(1), 90–96.‏

Landa, R. J., & Goldberg, M. C. (2005). Language, social, and executive functions in high functioning autism: A continuum of performance. *Journal of Autism and Developmental disorders,* 35(5), 557–573.‏

Lazenby, A. L., Lockyer, L., & Dennis, M. (2001). Inferential Language in High-Functioning Children with Autism. *Journal of Autism and Developmental Disorders*, 31(1), 47–54.‏

Livingston, L.A., Colvert, E., Bolton, P. & Happé, F. (2019). Good social skills despite poor theory of mind: exploring compensation in autism spectrum disorder. *Journal of Child Psychology Psychiatry, 60,* 102–110.

Longobardi, E., Spataro, P., Frigerio, A., & Rescorla, L. (2016). Language and social competence in typically developing children and late talkers between 18 and 35 months of age. *Early Child Development and Care,* 186(3), 436–452.‏

Lord, C., Rutter, M., & Le Couteur, A. (1994). Autism Diagnostic Interview-Revised: a revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders,* 24(5), 659–685.‏

Loveland, K. A., Pearson, D. A., Tunali-Kotoski, B., Ortegon, J., & Gibbs, M. C. (2001). Judgments of social appropriateness by children and adolescents with autism. *Journal of Autism and Developmental Disorders,*31(4), 367–376.‏

Macintosh, K., & Dissanayake, C. (2006). A comparative study of the spontaneous social interactions of children with high-functioning autism and children with Asperger's disorder. *Autism*, 10(2), 199–220.‏

MacKay, G., & Shaw, A. (2004). A comparative study of figurative language in children with autistic spectrum disorders. *Child Language Teaching and Therapy*, 20(1), 13–32.‏

Martelle, S. N., & Namazi, M. (2022). Feeling Thrown for a Loop? The Effects of Inferencing on Spoken Language Idiom Comprehension in Autism. *Language, Speech, and Hearing Services in Schools*, 1–14.‏

Mashal, N., & Kasirer, A. (2011). Thinking maps enhance metaphoric competence in children with autism and learning disabilities. *Research in Developmental Disabilities*, 32(6), 2045–2054.‏

McCabe, P. C., & Meller, P. J. (2004). The relationship between language and social competence: How language impairment affects social growth. *Psychology in the Schools,* 41(3), 313–321.‏

Meinhardt-Injac, B., Daum, M. M., Meinhardt, G., & Persike, M. (2018). The two-systems account of theory of mind: Testing the links to social-perceptual and cognitive abilities. *Frontiers in Human Neuroscience*, 12, 25.‏

Morsanyi, K., & Stamenković, D. (2021). Idiom and proverb processing in autism: a systematic review and meta-analysis. *Journal of Cultural Cognitive Science,* 5(3), 367–387.‏

Nah, Y. H., & Poon, K. K. (2011). The perception of social situations by children with autism spectrum disorders. *Autism*, 15(2), 185–203.‏

Norbury, C. F. (2004). Factors supporting idiom comprehension in children with communication disorders.‏

Perner, J., & Wimmer, H. (1985). “John thinks that Mary thinks that…” attribution of second-order beliefs by 5-to 10-year-old children. *Journal of Experimental Child Psychology*, 39(3), 437–471.‏

Pexman, P. M., Zdrazilova, L., McConnachie, D., Deater-Deckard, K., & Petrill, S. A. (2009). “That was smooth, Mom”: Children's production of verbal and gestural irony*. Metaphor and Symbol,* 24(4), 237–248.‏

Pilowsky, T., Yirmiya, N., Arbelle, S., & Mozes, T. (2000). Theory of mind abilities of children with schizophrenia, children with autism, and normally developing children. *Schizophrenia Research*, 42(2), 145–155.‏

Rapin, I. (1991). Autistic children: Diagnosis and clinical features. *Pediatrics*, 87(5), 751-760.‏

Rapp, A. M., & Wild, B. (2011). Nonliteral language in Alzheimer dementia: a review. *Journal of the International Neuropsychological Society,* 17(2), 207–218.‏

Raven, J., Raven, J., & Court, J. (2003). Manual for Raven’s progressive matrices and vocabulary scales. Oxford Psychologists Press.

Razza, R. A., & Blair, C. (2009). Associations among false-belief understanding, executive function, and social competence: A longitudinal analysis.*Journal of Applied Developmental Psychology,* 30(3), 332–343.‏

Roberts, R. M., & Kreuz, R. J. (1994). Why do people use figurative language?. *Psychological Science,* 5(3), 159–163.‏

Rundblad, G., & Annaz, D. (2010). Development of metaphor and metonymy comprehension: Receptive vocabulary and conceptual knowledge. *British Journal of Developmental Psychology,*28(3), 547–563.‏

Rutter, M., Bailey, A., & Lord, C. (2003). SCQ. The Social Communication Questionnaire. Torrance, CA: Western Psychological Services.‏

Saban-Bezalel, R., & Mashal, N. (2015). Hemispheric processing of idioms and irony in adults with and without pervasive developmental disorder. *Journal of Autism and Developmental Disorders,* 45(11), 3496–3508.‏

Saban-Bezalel, R., Dolfin, D., Laor, N., & Mashal, N. (2019). Irony comprehension and mentalizing ability in children with and without autism spectrum disorder. *Research in Autism Spectrum Disorders,*58, 30–38.‏ ‏

Satkoske, V., Migyanka, J. M., & Kappel, D. (2020). Autism and Advance Directives: Determining Capability and the Use of Health-Care Tools to Aid in Effective Communication and Decision-Making. *American Journal of Hospice and Palliative Medicine*, 37(5), 354-363.‏

Swineford, L. B., Thurm, A., Baird, G., Wetherby, A. M., & Swedo, S. (2014). Social (pragmatic) communication disorder: a research review of this new DSM-5 diagnostic category. *Journal of Neurodevelopmental Disorders,*6(1), 1–8.‏

Swinney, D. A., & Cutler, A. (1979). The access and processing of idiomatic expressions. *Journal of Verbal Learning and Verbal Behavior,* 18(5), 523–534.‏

Tannen, Deborah. (2005). Conversational Style: Analyzing Talk among Friends. Oxford: Oxford University Press USA-OSO.

Titone, D. A., & Connine, C. M. (1994). Descriptive norms for 171 idiomatic expressions: Familiarity, compositionality, predictability, and literality. *Metaphor and Symbol,* 9(4), 247–270.‏

Volkmar, F. R., Paul, R., Rogers, S. J., & Pelphrey, K. A. (Eds.). (2014). Handbook of autism and pervasive developmental disorders, diagnosis, development, and brain mechanisms (Vol. 1). John Wiley & Sons.‏ Chapter 6: School-age children with ASD (pp. 148–175).

Vulchanova, M., Saldaña, D., Chahboun, S., & Vulchanov, V. (2015). Figurative language processing in atypical populations: the ASD perspective. *Frontiers in Human Neuroscience, 9*.

Wechsler, D. (2003). Wechsler intelligence scale for children–Fourth Edition (WISC-IV). San Antonio, TX: The Psychological Corporation.‏

Whyte, E. M., Nelson, K. E., & Scherf, K. S. (2014). Idiom, syntax, and advanced theory of mind abilities in children with autism spectrum disorders.‏

Wilson, D., & Sperber, D. (2012). Meaning and relevance. Cambridge University Press.‏

**Tables**

**Figures**