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

Abstract

Figurative language is a central tool in enriching the spoken and written language as well as in creating a high linguistic level among skilled speakers. Studies have found gaps in the understanding of figurative language among children with ASD compared to their peers with typical development (TD). A core difficulty in children with ASD is associated with deficits in social situation understanding. Yet, no studies have been conducted so far to examine the relationship between understanding social situations (as a separate ability) and understanding irony and idioms. 58 participants, aged 8-11 participated in the current study, including 28 children with high-functioning ASD, and 30 children with TD matched by age, gender and non-verbal intelligence. All participants completed ToM (understanding other’s intentions), social situation comprehension, irony, and idiom comprehension questionnaires. We hypothesized that (1) TD children will outperform the ASD group in understanding irony, idioms, ToM as well as in understanding social situations; (2) positive relationships will be found between understanding social situations and understanding idioms and irony; (3) understanding social situations and ToM ability will predict irony and idiom understanding. Results showed that the first hypothesis was confirmed. We found positive correlations between understanding social situations and understanding idioms and irony in each group. However, when controlling the vocabulary, the links were attenuated. Finally, vocabulary has a bulk contribution to predicting the understanding of idioms and irony. Understanding social situations and ToM, together also have contributed to predicting idiom and irony understanding with unique contribution of ToM ability to irony understanding. Thus, the present study demonstrates that the factors that contribute to predicting the understanding of irony and idioms are vocabulary, understanding other’s intentions and social situation with more pronounced contribution of ToM ability to irony comprehension, supporting the role of social to understanding irony in particular.

**Introduction**

 Figurative language serves as a central tool in enriching social interactions and written language. The use of figurative language is prevalent in all kinds of discourse, 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 intend to convey (Glucksberg, 2001), thus violating the maxim of quality of Grice. Grice's maxim of quality states that the speaker should convey to the listener correct, true and non-false information (Grice, 1975). Thus, understanding all types of figurative language share a common characteristic - the listener must think beyond the literal meaning, retrieve the figurative interpretation from the mental lexicon, or compute the expression’s meaning and adjust it to the context (Bernstein, 1987; Berman and Ravid, 2010; Rapp & Wild, 2011). As such, difficulties in figurative language understanding may negatively affect educational achievements (Swineford et al., 2014) and social interactions, that may lead to 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 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 with 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 contribute to the figurative meaning) and literal plausibility (is the literal meaning plausible). Studies show that these dimensions impact the ability to understand idioms throughout life (Titone & Connine, 1994). For instance, transparent idioms are easier to understand than opaque idioms for 5 years old children (Gibbs, 1991). Nine year-old children can rely on the transparency of an idiom to understand its meaning out of context, but 7-year-olds could not ([Levorato & Cacciari, 1999)](https://www.sciencedirect.com/science/article/pii/S0022096508001173?casa_token=gsOtanLhRpwAAAAA:yc7UocrA52Tqpm54nxKL3Ho-HrBdi0uOMlrv4pDj1wNAsoHj_nYDbYFLC8fEKHeYjaX_hIeSxQ" \l "bib15). Fourteen years old adolescents outperformed 11 years 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#bib20)), attesting to the contribution of age to the development of idiom understanding (Saban-Bezalel & Mashal., 2019). Irony refers to conveying a message through a critical, skeptical, and even mocking attitude (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#B1-languages-04-00023)). Children begin to understand irony around the age of 5-6 years (Dews and Winner, 1997; Harris & Pexman, 2003), and continue to develop this ability through middle childhood, between about 7 and 10 years of age (Bosco & Bucciarelli, 2008; Filippova & Astington, 2008). Yet, 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, an age in which the understanding of figurative language still develops and has not yet reached its peak (Cain et al., 2009).

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

Various theories and models have been proposed to explain the difficulties in figurative language understanding in ASD. One of the main theories, the Theory of Mind (ToM), pertains to the core difficulty in ASD, namely the impairments in social communication and interaction (Baron-Cohen et al., 2001; Livingston et al., 2018). This theory postulates that people diagnosed with ASD have difficulty understanding the mental state of others, and therefore they are prone to deficient understanding of social situations and communication directed towards them. According to this view, ToM ability predicts pragmatics understanding (Cummings, 2013) and more specifically, figurative language processing among children and adults with ASD (Happe, 1995). Evidence suggests that this relationship is found between ToM abilities and the ability to understand idioms among ASD children, but not among TD children (Whyte et al., 2014). Furthermore, it has been suggested that first-order ToM ability is sufficient for understanding metaphors, but not for understanding irony, but second-order ToM ability predicts 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). The results showed that participants with TD outperformed the ASD group in irony comprehension, but when participants were matched on ToM ability (as assessed by the Hinting task) both groups showed similar performance in the irony comprehension task. These findings highlight the link between ToM ability and understanding idioms and irony among ASD.

Other researchers attribute the difficulties in understanding figurative language in ASD to difficulty in executive functions. Deficient mental flexibility can impair switching between the literal and the non-literal interpretation of a figurative expression (Landa & Goldberg 2005; Cummings, 2013). Evidence from previous studies shows that participants with ASD scored lower on figurative language tasks (Berman and Ravid, 2010; Norbury, 2004; Chahboun et al., 2021) and in most tasks involving executive functions, compared to their TD peers. Mashal and Kasirer's (2011) study found that children with TD outperformed their ASD peers matched in age and vocabulary in tasks taxing idiom and metaphor understanding. In that study children with ASD also showed decreased performed in tasks examining executive functions that are based on language. However, in these studies the correlation between EF and idiom comprehension was not tested. When tested, no significant relationship was found between executive functions and understanding figurative language (Landa & Goldberg, 2005). Thus, the contribution of EFs to idiom and irony comprehension remain unclear.

Another approach to explaining the difficulties in understanding figurative language among individuals with ASD is derived from the general difficulty in understanding language (Gernsbacher & Pripas-Kapit, 2012). In support for this claim a recent meta-analysis study (Kalandadze et al., 2018) found that the matching strategy to the control group, as well as the different aspects within the figurative language, have a clear connection to the differences in the size of the effect. That is, when the participants are matched according to language abilities, and especially according to vocabulary and syntactic capabilities, no significant differences were found in figurative language understanding between ASD and TD groups. The unique contribution of vocabulary to idiom comprehension performance in ASD was demonstrated in a recent study that showed that vocabulary contributed significantly to idiom comprehension performance, beyond age gender among participants with ASD but not among their TD peers (Saban-Bezalel & Mashal, 2019). Furthermore, previous studies show that general language comprehension abilities were found to be related to understanding ambiguous ideas, more so than the autistic characteristics of the participants in the study (Giora et al., 2012).

Another pertinent facet of children's developmental progress, potentially influential in comprehending irony, involves understanding social situations. ToM ability includes several skills, such as mindreading and empathy, required to manage social communication and relationships (Korkmaz, 2011). Children with more developed capacity to discern the emotions and feelings of others may demonstrate higher irony comprehension. Indeed, it has been shown that irony comprehension correlated with empathy skills (Nicholson et al. 2013). Thus, impaired ToM ability in ASD may coincide with deficient empathy and therefore may hamper irony comprehension.

The ability to understand social situations is a central issue in the study of ASD and it 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 showed difficulty in judging social appropriateness in situations presented through a video (Loveland et al., 2001) and they provide strange and inappropriate explanations to comics displaying events involving social inappropriateness (Nah and Poon, 2011). One of the accepted models for explaining the understanding of social situations, the intentions and needs of the other is the social information processing (SIP) model (Dowswell & Chessor, 2014). Accordingly, to behave appropriately and effectively in everyday situations, an individual has to process social information effectively, to perceive and interpret social cues accurately, to understand the goals, intentions and needs of the other in the context of the social situation, and finally to 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), EFs, and understanding of social situations (Razza & Blair, 2009). As indicated by the DSM5 (APA, 2013) individuals with ASD exhibit difficulties in social understanding, appropriate use of gestures and social skills, maintaining friendships, engaging in social play, and inferencing about social scripts (Bauminger-Zviely, 2013; Dennis et al., 2001; Machintosh & Dissanayake, 2006). These difficulties may negatively affect social interactions (Chung et al., 2007; Bauminger-Zviely, 2013). The current study seeks to assess social understanding among school children with ASD and TD children, using a questionnaire for understanding social situations and furthermore, to examine for the first time its link with idiom and irony comprehension. Apparently, there is a shared denominator in these abilities (figurative language and social situations understanding): processing social information necessitates to perceive, remember, and interpret social contexts using cues, as well as 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 is 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 three folds: 1) To examine understanding of idioms, irony, and social situations in ASD as compared to children with TD; 2) To examine the relationship between understanding social situations and understanding idioms and irony in each group separately; 3) To examine what abilities contribute to the understanding of irony and idioms with specific focus on the contribution of vocabulary, ToM and social situation comprehension. We hypothesized that children with TD will outperform the ASD group in idiom, irony, and social situation comprehension (Bauminger-Zviely, 2013; Berman & Ravid, 2010; Chahboun et al., 2021; Dennis et al., 2001; Norbury, 2004; Mashal and Kasirer, 2011; 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 share at least in part the understanding of other's intentions (thus requiring proper functioning of ToM) and executive function (Razza & Blair, 2009). Finally, we hypothesized that vocabulary and the understanding of both social situations and ToM ability will contribute to the explained variance of idiom and irony understanding. Unlike idiomatic expressions, ironic expressions depend more heavily on understanding social context and the speaker’s intention, thus, we expected that vocabulary (Saban-Bezalel et al., 2019), and understanding social situations and ToM ability will contribute to irony comprehension (Razza & Blair, 2009).

**Method**

**Participants**

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

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

**Table 1**: *Demographic and background characteristics by group and statistical comparison*

As can be seen in Table 1 no significant difference was found between the groups on age, gender, and non-verbal intelligence. However, children with TD scored higher on vocabulary than their ASD peers.

**Materials**

Verbal and non-verbal intelligence tests

1. *Vocabulary* was assessed using the vocabulary subtest from the Wechsler Intelligent Scale for children (Wechsler Intelligent Scale WISC-IVHEB). The Wechsler test was developed by Wechsler (Wechsler, 2003) in order to measure the cognitive ability of children aged 6-16 years. The test was translated and designed in Israel by Lieblich, Ben Shahar and Niño (1976). The reliability coefficient for the verbal IQ is 95. The reliability coefficient for the executive IQ is 92 and for general ability 96. Retest reliability is over 90. In the present study, a vocabulary subtest was used, which serves as one of the most important indicators of verbal ability. The test measures the quality of the language and the ability to learn, a database and understanding of the meaning of words and ideas. The test includes 35 items with a maximum raw score of 70 points.

2. *Non-verbal intelligence* was assessed using the RAVEN test (CPM Raven's Colored Progressive Matrices) (Raven et al., 2003). The test includes 36 items divided into 3 sets, with 12 items in each set. The items are arranged in order of increasing difficulty, as are the three sets in the test. For each item, the subject must choose the missing part that completes the picture shown to him. There is one correct answer out of 6 options. The score for a correct answer is 1, and 0 for an incorrect answer. The maximum score in the test is 36. The test is suitable for ages 5 and up. Test reliability ranges between r = .81 and r = .94, according to various studies, and test-retest reliability is over r = .80 (Raven et al., 2003).

Validation of the ASD diagnosis and ToM assessment

1. *The SCQ* was used to validate the ASD diagnosis of the subjects in the research group. The parents of the children with autism answered the Social Communication Questionnaire (SCQ) (Rutter, Bailey, & Lord, 2003). The SCQ questionnaire is a parental report questionnaire whose purpose is to find out whether the child is included in the autistic spectrum. This tool correlates with the ADI diagnostic questionnaire (Lord, Rutter, & Le Couteur, 1994) (r= 0.71). The SCQ questionnaire includes 40 items referring to the areas of communication, mutual social communication, interests and repetitive and stereotypical activities. The results of the questionnaire are summarized and rated on a scale of 33-0 for non-verbal children or a scale of 39-0 for verbal children. A score above 15 confirms a diagnosis of ASD, a score above 22 gives a classification of ASD. The questionnaire was found to have good diagnostic validity, with a sensitivity to diagnose autism at a level of 0.85, and specificity at a level of 0.75.

2. *Hinting test* (Corcoran, Frith & Mercer, 1995). The test tests the understanding of the other's intentions and was tested in patients with schizophrenia, and children with ASD (Pilowsky, Yirmiya, Arbelle & Mozes, 2000). The test was translated into Hebrew and used in a study with children and adolescents with ASD (Saban-Bezalel et al., 2019). The participant is presented with 10 short stories describing a situation between two characters. At the end of each story, a question related to understanding the speaker's intention is presented, which is 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 added: : "Dad, will the pet store be open on my birthday?". A correct answer earns the participant two points. The maximum score in the test is 20 points. If the subject is wrong, he gets a hint. If he manages to answer correctly using the hint, he wins one point.

*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. For each idiom four choices are presented: 1. correct answer; 2. Incorrect literal answer; 3. Another literal distractor; 4. An unrelated answer. The proposed options are displayed randomly. The subject is required to select the answer that is closest to the meaning of the entire sentence. For example, for the idiom "Sprinkling salt on the wounds" 4 alternatives were presented: A. spice spreader; B. Disinfects the warts; C. Talks about other people's failures and thereby causes him additional pain; D. listens to others. Participants receive one point for each correct answer.

The irony comprehension questionnaire (Saban-Bezalel & Mashal, 2015) includes 15 items: 10 items that include short text passages with ironic meaning and another 5 items that include short passages with literal meaning. The sections in the questionnaire are presented in random order. The subject must read each passage and answer an open question that refers to the intention or thought of the speaker. For example, the final exam lasted 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 receive one point for a correct answer with a maximum of 10 points for the ironic part and 5 points for the literal part. The score is converted to percentages.

*Social Understanding*

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

The questionnaire includes 10 items consisting of short stories accompanied by pictures (an example will be given below). Each item describes a problematic social situation. The participant is required to decide what is the worst thing in the specific situation. The stories refer 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 is a multiple-choice question, with four possible answers, one of which is correct. Participant scores one point for a correct answer, and an incorrect answer 0 points. The maximum score is 10 points. Cronbach's alpha test reliability coefficient is: 0.68 for ages 6-7, 0.75 for ages 8-9, 0.89 for ages 10-11. The validity of the test, according to the CFI (confirmatory fit index), 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 Univ. 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 during one session that lasted 60-90 minutes, in a quiet room in the participant’s home or at the school. The SCQ questionnaire was delivered electronically by Google Form software to the parents of the ASD participants. The rest of the questionnaires were delivered orally by the researcher who wrote down their responses on a page. The tests were administrated in a random order, to exclude possible effects between the tests.

*Data analysis*

To examine differences between the groups in understanding idioms, irony, social situations and ToM, a one-way multivariate analysis of variance controlling for vocabulary (MANCOVA) was conducted. Pearson correlations were performed to examine the relationships between understanding social situations and understanding idioms and irony in each group separately. 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 the Groups*

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

The analysis revealed a significant difference between the groups at the multivariate level, F (4,52) = 18.16, p < .001, $η\_{p}^{2}$ = .583. Post-hoc ANOVA were conducted to test group differences in each variable separately (see Table 2). As can be seen from Table 2, significant differences were found in all variables. That is, in accordance with the first hypothesis, children with TD outperformed the ASD group in idiom, irony, ToM, and social situation understanding (see Fig. 2).

**Table 2:** Mean, standard deviations and one-way MANCOVA analysis findings examining group differences in idiom, irony, and social situation understanding by group

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | 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 of understanding idioms, understanding irony, understanding social situations and ToM according to the research groups (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 link between understanding social situations with idiom and irony understanding correlations and partial correlations (controlling for vocabulary) were computed in each group separately. As can be seen from Table 3, Pearson correlations in each group are significant and positive. That is, according to the second hypothesis, the higher the understanding of social situations, the higher the understanding of both idioms and irony (see Fig. 3). These correlations were attenuated when controlling by vocabulary but still remain significant, except the correlation between social situation understanding and idiom understanding in the ASD group.

*The contribution of demographic and background variables, understanding social situations, and group affiliation to idiom and irony understanding*

Two hierarchical regression models were computed, one for predicting irony understanding and the other for predicting idiom understanding. In each model, in the first step, age and gender were entered as controlled variables. In the second step, vocabulary as well as non-verbal intelligence were entered. In the third step, group affiliation, understanding social situations and ToM (centered), were entered. In the fourth step, the interaction factors of group with understanding social situations and ToM were entered (see Table 4).

As can be seen from Table 4, the first step was not significant in both models with 1.9% and 4.8% explained variance (EPV) of the idiom model and the irony model, respectively. The second step, in which the vocabulary and non-verbal intelligence were entered, was significant for both models with an increase of 81.0% to the EPV of idiom understanding and an increase of 57.3% to the EPV of irony understanding. Examining the coefficients shows that in both models, only vocabulary has a significant unique contribution, so that higher verbal intelligence predicts a better understanding of idioms and irony. In the third step group affiliation, understanding social situations, and ToM, contributed significantly in both models, with an increase of 2.8% to the explained variance of idiom understanding and an increase of 32.1% to the explained variance of irony understanding. Examining the coefficients shows that none of the variables significantly predict idiom comprehension (although the entire step is significant). In the irony understanding model, a significant unique contribution was found for both the group affiliation and ToM. Finally, the fourth step was not significant in both the idiom model and the irony model, with 0.00% and 0.2% addition to explained variance, respectively. This finding shows that the relationships found in the third step do not differ between the two groups.

**\*\*\* Insert Table 4 about here \*\*\***

**Discussion**

The current findings suggest that participants with TD scored higher in understanding idioms, irony, ToM and social situation understanding, as compared to participants with ASD matched by age, gender and non-verbal intelligence. These results provide further support to previous studies that compared figurative language and social competence between children with TD and children with ASD (Berman & Ravid, 2010; Dennis et al., 2001; Norbury, 2004; Mashal & Kasirer, 2011; Saban-Bezalel & Mashal, 2015; 2019; Vulchanova et al., 2015). Thus, the current results demonstrate a gap in idiom and irony understanding in ASD as compared to TD in the age range 8-11 years where these aspects of figurative language mature but still developing.

In the second hypothesis we speculated that a positive relationship will be found between understanding social situations and understanding idioms and irony. Apparently, social situation understanding, and figurative language comprehension derived from different domains- the former from social cognition and the latter from figurative language processing. Figurative language, as part of the broader domain of understanding language in social context, namely pragmatics, is closely related to ToM ability (Bosco et al., 2018; Cummings, 2013) and ToM ability is linked to social situation understanding (Razza & Blair, 2009). To succeed in the current social understanding task participant must encode the given social information, interpret the social information such as cues, identify violation of norms of behavior (e.g., violating teacher’s privacy by rummaging the teacher’s bag), and understand its consequences, as well as to understand the beliefs and the intentions of the other. Therefore, it seems that there are shared abilities underlying these two apparently remote areas investigated in the current study. Our results thus show that the higher the understanding of social situations the higher the understanding of figurative language (idioms and irony).

Nevertheless, vocabulary seems to play an important role in understanding figurative language and understanding social situations. When controlling vocabulary, the correlations were attenuated in each group. Whereas the partial correlations between understanding social situations and figurative language remain significant among the participants with TD, the correlation between understanding social situations and idiom comprehension among children with ASD did not reach significance. This finding corroborates with the results obtained from the hierarchical regression, where verbal and non-verbal intelligence scores were entered in the second step of the model. vocabulary had a significant unique contribution (but not non-verbal intelligence), especially for idiom understanding. In particular, an increase of 81% to the EPV of understanding idioms and an increase of 57% to the EPV of understanding irony was observed. Thus, consistent with previous study (Saban-Bezalel et al., 2019) the higher vocabulary knowledge the better understanding of idioms and irony.

The third hypothesis focused on the contributions of ToM and understanding social situations to irony and idiom understanding. The current results show that group affiliation, understanding social situations, and other’s intentions contributed to both idioms and irony models. However, none of these variables significantly predict in isolation idiom comprehension (although the entire step was significant) whereas for irony comprehension, a significant unique contribution was observed for both the group affiliation and ToM (but not social situation understanding). In other words, being a TD child with higher ability to understand other’s intentions contributes to better understanding of irony. This finding attests to the differential characteristic of the ironic stimuli that involve understanding social scenarios in contrast to the idioms that were provided out of context.

There are several limitations that should be mentioned. The first limitation refers to the group difference in vocabulary knowledge. Although the children with ASD were high- functioning and recruited from communication classes in regular schools they still demonstrated lower vocabulary knowledge. Despite controlling vocabulary in the statistical analyses our findings are limited to children with TD matched by chronological age and non-verbal intelligence. Another limitation concerned the questionnaires that were used. Deeper inspection of the current questionnaires may explain the differential results obtained for the idiom and the irony models. Our findings show that vocabulary plays an important role in understanding idioms and irony among children with and without ASD (beyond 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 uniquely contributed to irony but not to idiom comprehension. This difference probably stemmed from the type of questionnaire used: the ironic stimuli were embedded within social situations whereas idioms were presented with no context. Our results also show that ToM ability but not to the performance in the social understanding questionnaire (CSCS) uniquely contributed to the understanding of irony. The CSCS, contrary to the Hinting test, requires social world knowledge for identifying violations of social norms therefore contributing less to the performance in the ironic scenarios (as compared with 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 sum, vocabulary plays a major role in understanding idioms and irony among children with ASD and their age-matched TD peers. This finding supports the model arguing that difficulties in figurative language understanding in ASD is consistent with a general difficulty in understanding language in ASD (Gernsbacher & Pripas-Kapit, 2012) as our ASD sample underscored in the vocabulary test compared with the TD group. Yet, other studies that used balanced groups in age and vocabulary reported poorer performance in figurative understanding tasks compared to controls. Our findings also highlight the contribution of ToM ability and social situation understanding xto both irony and idioms but understanding other‘s intentions uniquely predicted irony (beyond vocabulary) but not idiom comprehension. 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 their efficiency in promoting higher irony and idiom understanding in children and adolescents with ASD.

**References**

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

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. https://doi.org/10.1016/j.jecp.2008.08.001.

Demorest, Amy, Christine Meyer, Erin Phelps, Howard Gardner, and Ellen Winner. 1984. Words speak louder than actions: Understanding deliberately false remarks*. Child Development*, 55, 1527–34.

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, 3295–309

Harris, M., & Pexman, P.M. (2003). Children’s perceptions of the social functions of verbal irony. *Discourse Processes,* 36, 147–65.

Happé, F. (1995). Understanding minds and metaphors: insights from the study of figurative language in autism. *Metaphor and Symbol*, 10, 275–295. doi: 10.1207/s15327868ms1004\_3

Korkmaz, B. (2011). Theory of Mind and Neurodevelopmental Disorders of Childhood. *Pediatr Re,s* 69, 101–108. <https://doi.org/10.1203/PDR.0b013e318212c177>

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. <https://doi.org/10.1111/jcpp.12886>

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

Vulchanova, M., Saldaña, D., Chahboun, S., & Vulchanov, V. (2015). Figurative language processing in atypical populations: the ASD perspective. *Frontiers in Human Neuroscience, 9*. <https://doi.org/10.3389/fnhum.2015.00024>

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

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.‏

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.‏

Chahboun, S., Kvello, Ø., & Page, A. G. (2021). Extending the Field of Extended Language: A Literature Review on Figurative Language Processing in Neurodevelopmental Disorders. Frontiers in Communication, 143.‏

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.‏

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.‏

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.‏

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.‏

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.‏

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).

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.‏