

IRONY COMPREHENSION IN CHILDREN WITH ASD:
DOES MODALITY MAKE A DIFFERENCE?

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Abstract

The ability to comprehend irony is often impaired in children with Autism Spectrum Disorders (ASD), due to deficient perspective taking skills. This study explored irony comprehension in children with ASD, ages eight to eleven years, using the graded salience hypothesis and differing modalities of stimuli presentation. Both conventional and situation-specific ironic remarks were presented in either auditory or written form, following each story context. Following presentation of each short vignette and corresponding ironic statement, the participant's comprehension was measured based on their response to a series of auditory questions. Questions were designed to assess each child's ability to interpret speaker meaning, affect and intent. Due to their difficulty with integration of information across modalities, it was hypothesized that when presented with an ironic statement and corresponding questions in a single modality (e.g. only auditory), children with ASD would have increased comprehension, as compared to those statements presented across multiple modalities (e.g. written and auditory). Results indicated that no significant differences were found based on the modality of presentation or conventionality of a statement, as it relates to irony comprehension in the given population.

Introduction

Autism Spectrum Disorder (ASD) encompasses a group of developmental disorders which include a wide variety of symptoms, skills and deficits. Individuals with ASD often have deficits or excesses in communication, behavior and/or socialization, while also exhibiting repetitive behaviors and limited interests (National Institute of Mental Health, 2016; American Psychiatric Association, 2013). Symptoms, which are unique to the individual, range in severity and are classified based on the individual's impairment in social communication, and patterns of behaviors (American Psychiatric Association, 2013). It should be noted that individuals with ASD also differ greatly in their language abilities for vocabulary and grammar, while there appears to be a universal deficit related to pragmatics. Impaired ability to comprehend language in a social context also contributes greatly to this population's difficulty in comprehension of ironic language (Pexman et al., 2011). This difficulty with ironic language, a common piece of discourse in many cultures, may lead to negative experiences during social interactions, creating a potential for social exclusion (Persicke, Tarbox, Ranick & St. Clair 2013). With this potentially negative result comes the need for an increased understanding of this population's difficulty with comprehension and use of irony, in everyday discourse.

An ironic utterance is a non-literal statement that has a meaning which contradicts what is explicitly stated. This literary tool, which is frequently used to inadvertently criticize or ridicule, has been found in many languages and is often present at a young age. In one study by Pexman et al. (2011), ironic statements were found to be used and understood by typically developing children as young as five or six years of age. As they continue to develop into adolescence, children not only refine their ability to distinguish between literal and non-literal statements, but they also acquire an appreciation for the speaker's intent (Glenwright, & Pexman 2010). To

accurately interpret ironic utterances, the audience must attend to various pieces of information, often simultaneously. Interpretation often begins with an evaluation of the context of the situation and attention to the intonation used by the speaker (Capelli, Nakagawa & Madden, 1990). The audience must then infer the speaker's meaning, attitude and intent, in order to fully understand the nature of the utterance. The interpretation of a speaker's perspective, employed when determining intent, is a crucial part of irony comprehension and requires an advanced Theory of Mind (Banasik, 2013). Theory of Mind, which represents a person's ability to infer the mental states of others, is often a core deficit of individuals with ASD and may contribute to this population's difficulty with irony (Hale & Tager-Flusberg, 2005). Although many studies have examined the extent to which individual's with ASD struggle with irony comprehension, few have looked at the ways in which these individuals best comprehend ironic statements. Therefore, more research is needed in this area to determine the best way to present and teach irony comprehension, for this population.

When processing irony, it is imperative that the listener simultaneously interpret various pieces of information, often from different modalities (e.g. auditory or visual). Many aspects of language are considered cross modal in nature, thus difficulty in transitioning between modalities has been linked to language and social impairments, similar to those seen in individuals with ASD (Reed & McCarthy, 2012). The inability to integrate multimodal information during social exchanges may result in missed social cues or the alteration of the intended content of the message, both important components of irony comprehension (Stevenson, Segers, Ferber, Barense & Wallace, 2014). This ability to integrate information across auditory and visual modalities has been found to be impaired in individuals with ASD, and may be related to their difficulty in transitioning their attention once focused on a given stimulus. (Reed et. al., 2012;

Stevenson et al., 2014; Chahboun, Vulchanov, Saldaña, Eshuis, & Vulchanova, 2016). This difficulty in shifting attention can be explained by the theory of Weak Central Coherence, which describes the tendency of this population to perceive signals in isolation (Stevenson et al., 2014). It also explains why individuals with ASD have been found to process auditory information more readily, while often excluding visual information. With this difficulty in integration of multimodal information and potential for missed information during a communication interaction, comes the need for a better understanding of how individuals with ASD process information during these exchanges and how it impacts their comprehension.

Due to the lack of information in this area, this study sought to examine the role of modality of presentation in irony comprehension, thus yielding a better understanding of how these individuals best interpret ironic language. With this, researchers also hoped to gain insight into how individuals with ASD comprehend irony, as compared to typically developing children and those with specific language impairment. By exploring how conventionality and modality impact comprehension, this would allow researchers to determine two valuable pieces of information. Not only would it provide insight into this population's difficulty with irony, when encountered in discourse, but it would also allow practitioners to develop effective communication strategies and tailor intervention techniques specifically for those with ASD. In the current study, children were presented short stories and their corresponding ironic statement, in both auditory and written modalities. Each ironic statement was also formulated to be either conventional or situation specific. At the completion of each story, the children were then presented an audio recording which asked a series of open-ended questions followed by one forced choice question, designed to assess the participant's understanding of speaker meaning, affect and intent. It was hypothesized that if the stimuli are presented in only a single modality

(i.e. auditory), children with ASD will better comprehend each ironic statement, as compared to when presented across modalities (i.e. written and auditory).

Methods

Participants

Participants for the study were recruited from the greater Manhattan area through flyers posted in the community, Kansas State University publications, and emails via special educators and direct service providers. The eligibility requirements for inclusion in the study stated that participants: must be approximately between the 2nd and the 4th grade (7-11 years), have English as their primary language and have a diagnosis of ASD. Exclusionary requirements stated that any child reading two or more reading levels below their grade would not be included in the study. Five English-speaking males, ages eight to eleven years (8;2 - 11;3 years) ($M=10;0$ years, $SD=16$ months) with ASD were recruited and participated in the study. This specific age range was selected, as participants were expected to possess the ability to independently read and comprehend short stories. The severity of the participant's symptoms, as they relate to their diagnosis of ASD, was also measured using the Child Autism Rating Scale – 2nd Edition (CARS-2; Schopler, Van Bourgondien, Wellman & Love, 2010). This yielded an average T-score of 34.6 ($SD=16.06$, Range = <20-54). The range of T-scores as they relate to the severity of symptoms and ASD for the current sample are as follows: scores within 15-29 are considered minimal to no symptoms ($n=2$), 30-36.5 are mild to moderate ($n=1$), and scores of 37 or greater are considered severe ($n=2$). The socioeconomic status (SES) of the participants was also collected and averaged Upper Middle Class ($M= 61.6$, $SD= 17.7$, Range = 38-77), as measured by the Hollingshead scale (Hollingshead, 1975). All children were reported to have IQ scores within normal range, per parent report.

Materials and Design

Prior to their participation in the study, parents/caregivers completed a consent form which included demographic questions and those related to socioeconomic status. Additional items on the consent form included questions pertaining to hearing status, reading level and prior assessment results, including cognitive ability. Parents/Caregivers were also asked to complete the *CARS-2*, in order to assess their perception of the severity of the participant's ASD diagnosis and provide comments on areas impacted by the diagnosis. The protocol was also completed by the investigators following the conclusion of each session. The results of both assessments were then compared and scored according to the investigator's observations during the experimental session.

Experimental Task

The experimental task consisted of presentation of 22 short stories, featuring a gender-neutral character, Pat. Each story was adapted from a previous study which evaluated irony comprehension in typically developing children (Burnett, 2015). Each story utilized a context which would be familiar to the client and that featured either a positive or a negative outcome, as determined by the third sentence (see Appendix A). In a prior study, each story was rated according to degree of negativity, to ensure that the positive and negative stories were sufficiently different in terms of outcome (Burnett, 2015). Each story consisted of three sentences which provided the context, followed by an ironic statement. Each concluding ironic statement was either conventional (more salient) or situation specific (less salient), and was either strongly negative or strongly positive.

To account for the modality component of the study, each of the selected stories was randomly assigned to either an auditory or written presentation group. Eleven stories were

randomly selected for each modality, with six stories featuring a randomized combination of conventional and situation specific ironic statements. The other five stories consisted of three filler stories and two for practice. The filler stories each featured a literal concluding statement, while the practice stories were used to familiarize the participants with the experimental procedures. For the written modality, each of the eleven stories was typed using 14-point Comic Sans MS font, onto half of an 8.5 x 11" sheet of white printer paper. Story and modality order (i.e. auditory or written present first) were also controlled through randomization prior to the study.

In addition to the stories presented, two black and white illustrations were provided to assist in comprehension. Each illustration was adapted from the previous study by Burnett (2015), and contained information regarding the important aspects of the story, while depicting the character without facial expression (see Appendix A). The lack of facial expression was used in order to eliminate a potential confound regarding the participants understanding of irony (Burnett, 2015).

A set of questions was also developed for each story, to assess the participant's comprehension of each ironic statement. Each question was designed to evaluate the child's understanding of speaker meaning, attitude and intent, and was presented through auditory recordings at the conclusion of each story (see Appendix A). Four questions were presented in an open-ended format, to gauge the child's true comprehension of the ironic statement. The fifth and final question was designed to assess the child's understanding of speaker intent through forced choice. However, the practice stories in the written modality did not include a forced choice question. The presentation of each of the eleven forced choice questions was randomized,

to ensure an equal amount of questions regarding good and bad intent. Each of the five questions was adapted from the study the Burnett (2015) study.

For the questions and stories presented verbally, the recordings were also adapted from the Burnett (2015) study. Each recording featured a female speaker who read each story and included questions which used prosody consistent with the ironic and literal remarks (Burnett, 2015).

Procedure

Children participated in two separate tasks within an approximately 1-hour period. One task consisted of stimuli presented only verbally, while the other required the children to read each story and listen to the questions presented verbally. The order of each story presentation was counterbalanced to eliminate any possible order confounds. The study was conducted at Kansas State University's Speech and Hearing clinic, in one of the available clinic rooms. Each room was equipped with audio and video recording, so that each session could be replayed after its completion. Additionally, the children's parents were allowed to observe the session through the video recording system and each session was also monitored by the principle investigator.

For each experimental task, the child and investigator were seated at a table. Prior to beginning the experimental task, a brief explanation of the session schedule was provided and assent was obtained. Once assent was attained, the first story was presented either through a recording or in written form along with its corresponding pictures, beginning with two practice stories. Each practice story sought to ensure that the child was familiar with the procedure and that there were no questions regarding the presented tasks. After the practice stories were completed, six experimental items and three filler stories were presented in a randomized order. At the conclusion of each story, each participant heard a set of five questions which were

presented in a fixed order, via an external speaker. Of the five questions presented, four were open-ended followed by a fifth that was forced choice. After each question, the investigator paused the recording and allowed approximately 5 seconds for a response. Each response was then briefly recorded by the investigator on a data sheet. If the child gave no response or responded that they did not know the answer, the investigator made note of the response and proceeded to the next story. At no time did the investigators comment on that nature of the response given, but only reinforced attention and behavior during each story presentation. At the completion of the first 11 stories, participants were given the option of taking a short break. This was done in order to reduce any fatigue experienced during the tasks. After the break, the second set of stories was presented and the procedures were repeated verbatim from the first task. At the conclusion of the session, participants were given \$20 and the choice of an item from a prize box, to compensate them for their time and participation. Investigators then completed the CARS-2 protocol, to provide a subjective rating of the severity of the participant's diagnosis, as judged by their behavior during the session. After all sessions were completed, each participant's data was scored according to the response given.

Scoring and Reliability

Participants' answers were recorded via short hand during each of the sessions. After all data was collected, each response was scored as either correct or incorrect. Participants were awarded a "1" if the answer was deemed correct and a "0" if incorrect. The scoring criteria for each question is as follows: For questions in which the participant responded that they did not know the answer or did not provide an answer, the answer was discarded from their overall score. For the fact question, a "1" was awarded if the participant demonstrated a basic understanding of what occurred during the story, through their ability to report main details. A "1" was awarded

for the meaning question if the participant stated that the meaning was opposite of what was explicitly stated. For the affect question, a “1” was awarded if the participant could accurately describe how the character was feeling. For the intent question, “1” was awarded if the participant could state why the character would say the concluding statement, or how the character wanted to make their conversational partner feel (e.g. “Pat wanted to make his friend feel bad”). Lastly, for the forced choice question, a “1” was awarded if they participant provided the correct response. Both the fourth and fifth questions were designed to assess the speaker’s intent, thus if one questions was answered correctly, the participant was said to have accurately interpreted the speaker’s intent. Only the stories containing ironic statements were included in the overall score, thus the responses from the practice and filler stories did not contribute to the total score. Each participant’s data was initially scored by the investigator who collected the data, however all data was reviewed by both investigators to insure interrater reliability. Twenty percent of the data was then reviewed by undergraduate students in the communication sciences and disorders program. Reviewers were informed of the scoring procedures, but had no prior knowledge of the research question or the study’s purpose.

Results

Possible scores for each story type (e.g., written modality and novel/situation-specific remark, auditory modality and conventional remark) ranged from 0 to 3. Possible scores for the modality condition (written vs. auditory) ranged from 0-6 (see Table 1 for descriptive statistics). No significant differences ($\alpha=.05$) were found using two-tailed paired *t*-tests based on the conventionality of the statement or modality of presentation, as it relates to the participant’s ability to interpret speaker meaning, attitude or intent. For speaker meaning, results were contradictory for different participants where some performed better for the written modality

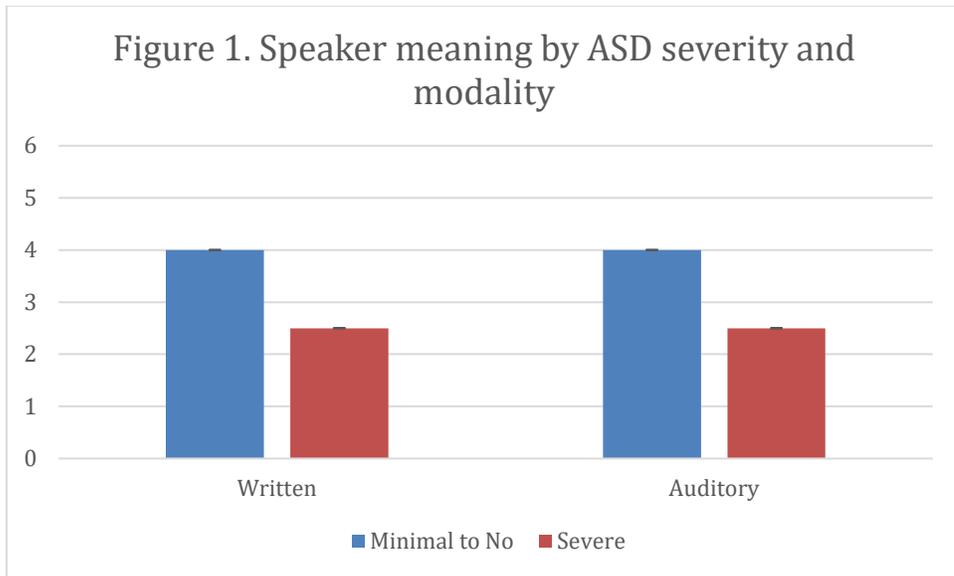
while others did so for the auditory modality. For speaker affect, there was a ceiling effect in that most children were able to determine if the speaker was feeling a positive or negative emotion. For speaker intent, there were two possible ways that the child could answer the question. An open-ended question followed by a forced choice question allowed the child to indicate if the speaker, i.e. Pat, wanted to make the listener feel good or bad about what had occurred. Further exploration of the role of question type and the performance of the participants, particularly with the ability of children with ASD to answer various types of questions, would be helpful in future research.

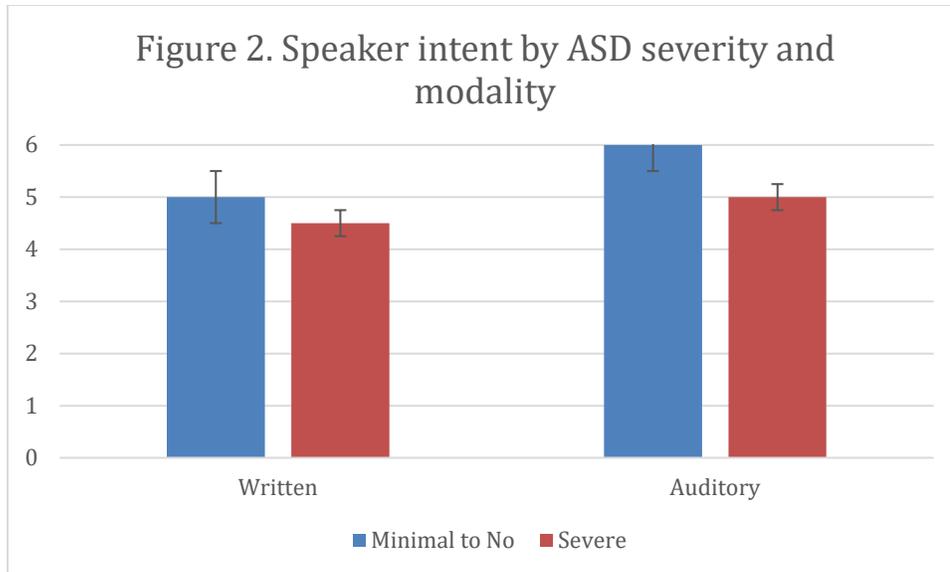
Table 1. Average scores by modality and remark type (possible scores for each range from 0-6).

Question Type		Story Modality		Remark Type	
		Written	Auditory	Novel	Conventional
Meaning	<i>M</i>	3.0	3.0	2.2	3.6
	<i>SD</i>	2.0	1.73	2.28	1.67
Affect	<i>M</i>	5.8	5.8	5.8	5.8
	<i>SD</i>	0.45	0.45	0.045	0.045
Intent	<i>M</i>	4.2	4.8	4.6	4.2
	<i>SD</i>	1.48	1.64	1.67	1.48

No significant correlations were found ($\alpha=.05$) between CARS-2 scores and performance on the experimental task. However, when examining the results, with a larger sample, further evaluation of the relationship between severity of ASD diagnosis and performance with irony comprehension is warranted, particularly for interpreting speaker meaning and intent. The

performance of the two participants with a CARS-2 score indicating minimal to no symptoms of ASD was compared with the performance of the two children with severe symptoms. With increased severity of ASD, there is the potential for increased difficulty in either a written or auditory modality when interpreting what an utterance might mean (see Figure 1). Within the area of speaker intent, or why a speaker would use an ironic utterance, there may be a possible interaction between severity of ASD and modality (see Figure 2).





Discussion

This study sought to examine how individuals with ASD comprehend irony and the role that modality of presentation plays in their interpretation of this literary tool. According to the theory of Weak Central Coherence, individuals with ASD may have more difficulty perceiving and attending to multiple signals simultaneously, and therefore often have more success when focusing on one stimulus at a time (Stevenson et al., 2014). Studies have also shown that individuals with ASD often process auditory information more efficiently, while also tending to exclude visual stimuli. With this in mind, it was hypothesized that ironic statements presented in a single auditory modality would result in greater comprehension as compared to those presented across both auditory and visual modalities. The results indicated that there was no significant correlation between single modality presentation and increased comprehension of ironic statements, thus the hypothesis was not supported. Although the results did not prove to be significant, there were several factors that may account for this lack of significance. First, this study included a small sample size. Although sample sizes are often smaller for special

populations, this extremely small sample size greatly limits the generalizability of the findings. In future studies, researchers should recruit a larger sample in order to ensure that results more accurately represent the target population. Additionally, the five children included in the study were highly variable in the severity of their diagnosis, as determined by their scores on the CARS-2. With this variability in severity comes the potential for decreased or increased attention during experimental tasks, potentially impacting their comprehension. This assertion can be seen through one participant who presented with minimal to no symptoms of ASD and received perfect scores across all tasks. Although our data did not produce a direct correlation between severity of diagnosis and comprehension ability, it is interesting to note this phenomenon, which should be explored further in future studies.

Although the results of this study remain inconclusive, the importance of determining how this population best comprehends irony still remains. With the prevalence of non-literal language in everyday discourse comes the importance for this population to both accurately comprehend and use this literary tool. It also remains imperative that practitioners determine the most effective way to present and teach irony comprehension in children with ASD; thus reducing the likelihood of negative social exchanges caused by the inability to recognize irony. Although not statistically significant in this study, the potential still exists for modality of presentation to play a role in this populations comprehension of irony, thus warranting future studies that explore this component in greater depth.

Appendix A

Comprehension Questions Format (Burnett, 2015)

Fact question: *Can you tell me what happened in the story?*

Speaker meaning: *What did Pat mean by “[target remark]”?*

Speaker attitude: *How did Pat feel when [event outcome]?*

Speaker intent open-ended: *Why did Pat say, “[target remark]”?*

Speaker intent forced-choice: *Did Pat want to make Pat’s friend feel [good/bad]?*

Example story contexts, target remarks, comprehension questions, and illustrations for the ‘Spill’ stories (Burnett, 2015).

Strongly negative context + Conventional ironic remark

Pat asks a friend to carry a vase of water to the table.

Pat’s friend is not being very careful and slips.

The vase breaks and water spills everywhere.

Pat says, “Smart move.”

Comprehension questions:

Fact question: *Can you tell me what happened in the story?*

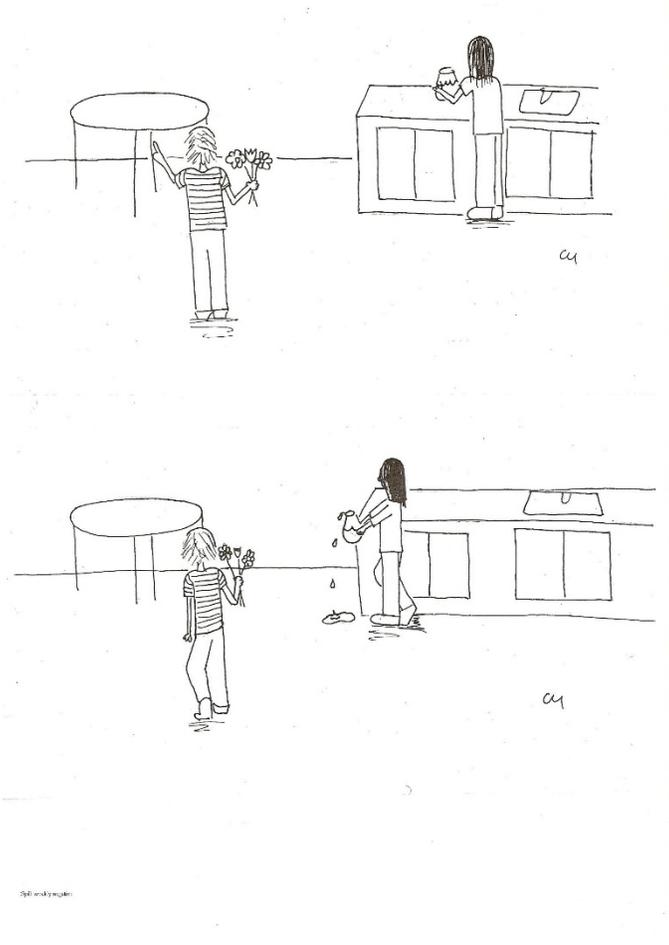
Speaker meaning: *What did Pat mean by “Smart move”?*

Speaker attitude: *How did Pat feel when Pat’s friend broke the vase and spilled the water?*

Speaker intent open-ended: *Why did Pat say, “Smart move”?*

Speaker intent forced-choice: *Did Pat want to make Pat’s friend feel bad?*

Illustration Accompanying Spill Story



Spill story regular

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