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The effects of modulating contrast in verbal irony as a cue for giftedness

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Abstract: This study adds to the existing literature on the ability to understand irony of typically developing versus gifted students (aged 12–15). In addition to the canonical condition of polarized statements applied to oppositely polarized situations, we also considered the case of intermediate statements and situations. The results showed a significant difference between the two groups of participants. Both groups recognized an ironic interpretation in the more usual condition of a polarized statement applied to a clearly oppositely polarized situation and they also grasped the idea that the bigger the contrast, the more ironic the message. However, gifted students demonstrated greater mastery, with regard to both polarized and intermediate statements. They also demonstrated greater ability compared with their non-gifted peers in the task which required them to explain the “rule” underlying the conditions which applied to the comments they had judged as ironic and to then produce ironic stories demonstrating the specificity of irony (not to be confused with generic humor).

Keywords: verbal irony, giftedness, contrast, opposites, intermediates, perceptual structure of dimensions

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1 Introduction

It has been well documented in literature in the disciplines of Psychology and Linguistics that verbal irony is based on a “discrepancy” between a comment and its referent situation or a comment and the speaker’s expectations. This discrepancy has been described in many ways, e.g. as an incongruity, an opposition, a contradiction, a gap, or a contrast (e.g. Calmus and Caillies 2014; Giora 1995; Haverkate 1990; Colston 2002). A clear example of irony is, for instance, when a person comments “What a bright and sunny day!” on a cloudy and rainy day, but an ironic remark can play on various modulations of contrast. In addition to canonical ironic statements based on a strong contrast, even weaker contrasts such as those implied in understatements, overstatements and hyperboles (e.g. Colston 2002; Colston and O’Brien 2000a, 2000b) and modulations of contrast based on negation (Giora et al. 2005, 2015, 2017) are perceived by adults as ironic. Investigations into irony as a scalar phenomenon has led to the discovery of another form of irony which has been named “intermediate”¹ (Cori et al. 2016; Canestrari and Bianchi In press). This form is twofold: 1) on the one side it refers to the case of polarized comments applied to situations which are perceived as intermediate (for example, Mary likes to drink very icy water but the barman gives her a glass of lukewarm water and she says: “I just love places where they serve very icy water”) and on the other side it refers to intermediate comments applied to polarized situations (for example, Mary likes to drink lukewarm water but she is given a glass of icy water and she says: “I just love places where they serve lukewarm water!”). Both examples play on the region of a dimension which is in between the two poles (i.e. neither hot nor cold but lukewarm) rather than on gradations of one pole (i.e. hot, boiling) or the opposite pole (i.e. cold, freezing). Intermediate verbal irony differs from understatements which also play on modulations of contrast (e.g. Gibbs 2000; Herrero Ruiz 2009) in that the former specifically modulates the contrast between one of the two opposite poles of a given dimension (e.g. hot or cold) and its intermediate region (e.g. lukewarm). Conversely, understatements are characterized by a

¹ We use the term “irony” as an umbrella term (as in Gibbs 2000, for example) to indicate a form of figurative language characterized by a contrast between what is said and what is observed or expected. The contrast can assume different modulations. It can be within gradations of the same pole of a given dimension (i.e. understatement or overstatement known as a “contrast of magnitude” by Colston and O’Brien’s, 2000a) or between two opposite poles of a given dimension (i.e. a “contrast of kind,” adopting Colston and O’Brien’s terminology) or between one of the two opposite poles and the intermediate region of a given dimension (i.e. “intermediate verbal irony,” as in this paper and in Cori et al. 2016; Canestrari and Bianchi In press).

contrast of magnitude (Colston and O'Brien 2000a) which is usually meant to remain within a range of gradations of the same pole in the same way as a less negative comment refers to a very negative situation or, using water as an example, when cool water is served instead of icy water. Conversely intermediate regions are perceived as being “neither one pole nor the opposite pole,” e.g. neither rainy nor sunny, neither hot nor cold, neither high nor low, neither at the top nor at the bottom, etc (on the existence of this region in human direct perceptual experience, see Bianchi et al. 2013, 2011a, 2011b, submitted).

There is evidence that producing and understanding verbal irony are related to many abilities which fall under the general term “intelligence.” For example, non-verbal intelligence is positively correlated to the degree to which adults perceive themselves as ironic (Milanowicz 2013), emotional intelligence plays an important role in the detection of an ironic interpretation of an utterance (Jacob et al. 2016) and theories of the mind are related to both understanding irony and intelligence (e.g. Akimoto et al. 2012; Angeleri and Airenti 2014). The present research contributes to this literature by investigating how typically developed children specifically understand the case of intermediate verbal irony and offers a comparative analysis of the performance of typically developed versus gifted children and gifted children versus adults. Neither of these aspects have, to date, been explored in the literature on the subject.

According to Subotnik et al. (2011), giftedness is the manifestation of performance or production that is clearly at the upper end of the population distribution. High IQ levels reflect a broader and deeper capacity to comprehend the environment, “catching on,” “making sense” of things, and “figuring out” what to do (Gottfredson 1997). In the early stages, potentiality is the key variable; in later stages, achievement is the measure of giftedness and in the case of fully developed talent, eminence is the basis on which this title is granted. Psychosocial variables play a role in the manifestation of giftedness at every developmental stage (Reis and Renzulli 2009) and indeed both cognitive and psychosocial variables need to be deliberately cultivated (Chung et al. 2011; Shi et al. 2013). Gifted children have an accelerated cognitive development compared to their peers. Their language is already well developed at 2–3 years of age (e.g. Gross 1999; Hoh 2005). This also includes the ability to understand and use humor and irony, which involves metalinguistic skills concerning words and language – another feature typically characterizing giftedness (Bernstein 1986; Hoh 2005; for a review, see Cukierkorn et al. 2008). The greater ability of gifted individuals to produce and understand humor is confirmed in several comparative studies (Bergen 2009, 2014; Holt and Holt 1995; Klavir and Gorodetsky 2001; Pieterl et al. 2011; Shade 1991; Sharifi and Sharifi 2014; Ziv and Gadish 1990).

Despite this abundance of experimental and comparative studies on *humor* in gifted individuals, their specific ability to understand and produce verbal *irony* has been far less thoroughly studied. Verbal irony is a form of figurative language and gifted people/population have a special ability to understand and use figurative language. Likewise, one of the pragmatic functions of irony is humor (e.g. Calmus and Caillies 2014) and gifted people have a special ability here too. We put forward the hypothesis that the production and understanding of verbal irony might be one way to reveal the presence of giftedness given that, in general, comprehending and producing irony is cognitively demanding and, in particular, understanding intermediate verbal irony is more complex than understanding irony based on modulations of contrast between two opposite poles or on gradations of one of the two opposite poles. In fact, intermediate verbal irony is *implicitly evaluative* since the target word (for example “lukewarm” in the comment “I just love places where they serve lukewarm water!”) cannot be replaced by its semantic opposite and this implicitness makes the comment more difficult to understand than *explicitly evaluative* irony (Burgers et al. 2012). More specifically, the aim of our study is to provide further insights into the understanding and production of irony in gifted and non-gifted students. Furthermore, since the cognitive development of gifted children is accelerated, it makes sense to compare their ability to understand irony (both in general and specifically when intermediate irony is involved) to that of adults. In order to pursue these aims, we extended the investigation of verbal irony from more typical conditions involving polarized statements applied to oppositely polarized situations to conditions involving intermediate states and situations (see Section 3). Bearing in mind that there have been no studies on the cognition of gifted and non-gifted students with regard to intermediate verbal irony or on the cognition of gifted individuals with regard to verbal irony in general, our only theoretical starting point is the literature on the cognition of the non-gifted population with regard to verbal irony. This is reviewed in the next paragraph.

2 Cognitive evolution and the detection of discrepancies in verbal irony

Understanding an ironic remark means detecting the underlying discrepancy and appreciating its pragmatic value which might be humorous, condemning or self-protecting (Colston and O'Brien 2000a, 2000b; Gibbs 2000) or which serves to hedge an insult, show emotional control (Dews et al. 1995) or politeness (Matthews et al. 2006). Accordingly, scholars who wished to study the cognitive

development of verbal irony understanding, started by verifying the ability of children to detect ironic discrepancy. They then tested children's capacity to recognize the pragmatic values conveyed by an ironic remark (e.g. Dews et al. 1996; Filippova and Astington 2010; Hancock et al. 2000; Harris and Pexman 2003; Pexman and Glenwright 2007; Pexman et al. 2005). The main finding which emerged was that 5–6 years old children are able to detect a discrepancy between what a speaker says and the referent situation, just as they are able to infer the counterfactual belief of the speaker. However, when the cognitive task is to infer the the speaker's attitude, younger children are more conditioned than older children and adults by intonational cues and contextual information (Ackerman 1982, 1983). Sensitivity to pragmatic aspects is acquired at a later stage, depending both on the pragmatic function implied (e.g. meanness vs. funniness) and the kind of irony (e.g. a compliment vs. a criticism; sarcasm vs irony) (e.g. Dews et al. 1996; Filippova and Astington 2010; Glenwright and Pexman 2010; Glenwright et al. 2013; Harris and Pexman 2003; Pexman et al. 2005). In other words, the capacity to understand what a speaker believes (i.e. what they mean) appears at an earlier stage than the capacity to understand why a speaker uses irony.

Studies based on children's comprehension of simple material suitable for their age and observations on everyday situations have demonstrated that an understanding of ironic comments emerges in early childhood and increases with age. For example, a study with 210 normally developing Finnish children from 3 to 9 years old showed that while a few younger children were able to recognize irony, there was a significant jump in the ability to recognize irony between the ages of 6 and 7 years. Moreover, they found that while none of the 3 years old children were able to explain the meaning of the ironic remarks correctly, all of the 9 years old children participating in the study were able to do this (Loukusa and Leinonen 2008). These results are consistent with the outcomes of three other studies. In one of these studies (Bosco and Bucciarelli 2008), children were presented with simple and complex ironic comments with the aim of establishing whether it was the case that the longer the inferential chain required to understand an ironic content, the more complex the irony was supposed to be. Children aged 6 were less able than 8 and 9-year-old children to understand both simple and complex irony. All groups were better at understanding simple as compared to complex irony. Another of these studies focused on the production and understanding of verbal irony in natural contexts (i.e. at home with their family) in children aged 4 and 6 years (Recchia et al. 2010). The study showed that even at this young age, children are able to reply to ironic remarks, suggesting that they understand the discrepancy between what is said and the intended meaning, as well being able to capture the relative pragmatic functions. This was especially

true for sarcasm and rhetorical questions used in an ironic way (Recchia et al. 2010). Another study on understanding and explaining verbal irony confirmed that while the detection of ironic discrepancy emerges in early childhood, explaining why a comment is ironic is a later ability. An explanation task was used with 100 typically developing Italian children ranging from 3 to 6 years old (Angeleri and Airenti 2014). They found that the ability to infer false belief concerning a state of affairs and to understand someone else's false belief – assessed by means of using 3 Theory of Mind tasks (Smarties, Sally-Anne and the Icecream van) – had a positive correlation with the ability to understand the communicative intent of ironic remarks, something which develops with age.

This finding was also confirmed in studies where ironic criticisms (i.e. positive evaluations of negative situations), ironic compliments (i.e. negative evaluations of positive situations) and literal criticisms and compliments were used as stimuli. By comparing 5–6 year olds, 8–9 year olds and adults, Dews et al. (1996) found that while literal remarks were understood equally easily by the three groups, the ability to detect a discrepancy between what is said and the intended meaning emerges at 5–6 years of age (especially in the case of ironic criticisms) and develops with age. The emergence of the cognitive ability to understand verbal irony at 5–6 years is further confirmed in a study involving familiar scenarios (Hancock et al. 2000) and by Harris and Pexman's study (2003). In the latter case, literal and ironic criticisms and compliments were considered and questions regarding the speaker's beliefs were asked to 5–6 and 7–8 years old children, for example, there was a scenario where a character named Sam worked either well or badly at his gardening and the children were asked: "When Bob said '*You are a great gardener*' did Bob think that Sam was a good gardener or a bad gardener?" Ironic criticisms were understood more frequently than ironic compliments in both groups, but older children were more accurate in perceiving that the speaker's belief was negative when an ironic criticism was used. Ironic compliments were poorly understood by both groups, independently of age.

At 7, 8, and 9 years of age this ability is consolidated in most children. They succeed in detecting an ironic discrepancy both in ironic criticisms and compliments (although a better performance was found with ironic criticisms) and this was not affected by the type of relationship between the speaker and listener, for instance whether they were strangers, friends or enemies (Pexman et al. 2005). Eight-year-old children are able to detect that an ironic remark alludes to behavioral expectations or social conventions that are betrayed (Creusere 2000). At 7 and 8 years of age, children are able to infer the speaker's attitude and intent, both when conventional (i.e. familiar) and non-conventional (i.e. non-familiar) ironic remarks were used, although they performed better in the former case (Burnett 2015).

Fewer studies have focused on the production of irony. Pexman et al. (2009) analyzed spontaneous conversations in small groups composed of two children (between 3 to 15 years old) and a parent while they were engaged in a cooperative task. The analysis of verbal and gestural interactions revealed that adults used gestural (i.e. non-verbal) irony with younger children ($M_{\text{age}} = 6.74$) more frequently than with older ones ($M_{\text{age}} = 9.72$). Conversely, children used gestural irony more frequently than verbal irony, irrespective of their age.

Taken as a whole, these studies show that in typically developing children, the understanding and production of verbal irony increases with age and continues to develop through late childhood. Despite the fact that full mastery of verbal irony, including sensitivity to its pragmatic functions, is acquired in adulthood, at 7 to 9 years of age most children are already able to understand canonical forms of irony, i.e. when polarized positive statements are used to comment on a clearly negative situation (and vice versa).

As pointed out in the introduction (Section 1), to the best of our knowledge, no previous experimental studies have been conducted with the aim of directly comparing the performance of gifted versus normally developing participants in tasks involving both the recognition and production of irony, in particular in cases involving modulations of contrast. The main aim of this study was to investigate whether there are any differences in young people's ability to grasp verbal irony in situations involving intermediates.

3 The study

In this study we aimed to address three main issues: different types of contrast versus identity, normal versus gifted children, and sensitivity to the differences between various situations which lie in between two poles.

3.1 Different types of contrast versus identity

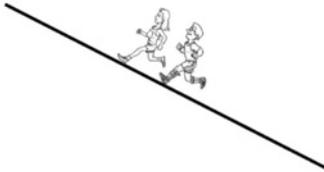
We investigated whether children aged 12 to 15 understand that verbal irony presupposes a contrast between a comment and the referent situation while a literal interpretation presupposes a relationship of identity; furthermore, we wished to quantify the degree of contrast which is necessary for a comment to be considered ironic. In order to test this, five different alternatives were considered for every scenario presented, ranging from one pole (indicated by A in the following graphs and figures) to the opposite pole (indicated by B in the following graphs and figures) and three situations in between the poles. As part

of this investigation, we studied the various different conditions of contrast and identity contained in:

(I) *polarized statements* (e.g. “it’s all uphill”): in addition to the two more obvious cases of a polarized statement applied to a *similar* strongly (Figure 1(A)) or weakly (Figure 1(i1)) polarized situation and to a clearly *opposite* polarized situation (Figure 1(B)), we studied whether the participants perceived irony in a polarized statement when it referred to a weakly polarized opposite situation (Figure 1(i3)) or to a situation showing an *intermediate state*, i.e. one which is not polarized (Figure 1(i2)).

Mark and Cindy are training for the marathon. Just for fun, they decide to try a new path. According to the information they got from their friends, the path should be all uphill. After a few hundred meters they realize that the path...

A) is all steeply uphill



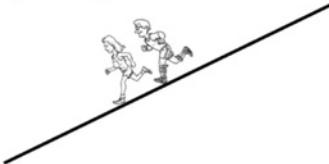
i1) is slightly uphill



i2) is all exactly on the level



B) is all steeply downhill



i3) is slightly downhill



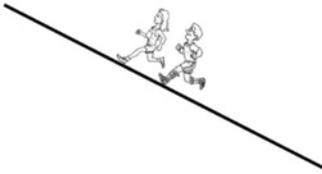
So Cindy exclaims: “Hmm, it’s all uphill!”

Figure 1: Examples of the different identity and contrast relationships between the situation and the statement in the experimental task with a polarized statement (“Hmm, it’s all uphill!”). This statement referred to a *similar strongly* (A) or *weakly* (i1) polarized situation, a *clearly opposite* (B) or *weakly opposite* (i3) polarized situation and to a situation showing an *intermediate, non-polarized* state (i2).

(II) *intermediate statements* (e.g. “it’s neither uphill nor downhill”): we investigated whether participants perceived irony in intermediate statements referring to *strongly polarized situations* (Figure 2(A) and 2(B)), *weakly polarized situations* (Figure 2(i1) and 2(i3)), and whether they grasped the literal meaning of intermediate statements referring to *intermediate situations* (Figure 2(i2)). In the present experiment, we used a subset of the stimuli (scenarios and pictures) used in a previous study carried out with Italian undergraduate students (Canestrari et al. In press; Cori et al. 2016) which proved that (in Italian) polarized comments referring to intermediate situations are understood as being equally ironic as intermediate comments referring to polarized situations.

Mark and Cindy are training for the marathon. Just for fun, they decide to try a new path. According to the information they got from their friends, the path should be neither uphill nor downhill. After a few hundred meters they realize that the path...

A) *is all steeply uphill*



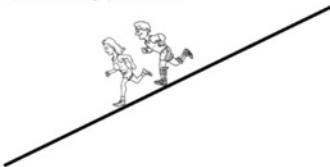
i1) *is slightly uphill*



i2) *is all exactly on the level*



B) *is all steeply downhill*



i3) *is slightly downhill*



So Cindy exclaims: “Hmm, it’s neither uphill nor downhill!”

Figure 2: Examples of the different identity and contrast relationships between the situation and the statement in the experimental task with an intermediate statement (“Hmm, it’s neither uphill, nor downhill!”). This statement referred to *strongly polarized situations* (A, B), *weakly polarized situations* (i1, i3), and to a situation showing an *intermediate, non-polarized, state* (i2).

3.2 Normal versus gifted children

It has already been shown that children generally start to perceive irony around the ages of 5–6 and this ability increases with age. In particular, they are able to detect the irony present when, for example, their parents praise them for bad behavior (see Section 2).

In the literature on giftedness, this ability is considered to be an indication of a more general capacity related to theory of mind and linguistic competence. However, while comparative studies regarding how adults and children understand irony have been carried out (e.g. Dews et al. 1996; Filippova and Astington 2008, 2010), to our knowledge there have been no experimental studies comparing the performance of typically developing versus gifted students. The present study aims to address this point. We focused in particular on the ability to recognize (implicitly and explicitly) that there is a difference between the literal and ironic interpretations attributed to statements in terms of the relationship between what the statement says and the situation which is being commented on. Of course, pragmatic aspects play a role here too and in particular we may need to understand why a speaker uses irony. In any case, detecting a discrepancy between what is said or expected and the referent situation is a necessary condition for verbal irony to be understood. In fact, in the literature on children's comprehension of verbal irony (reviewed in Section 2), tasks with the aim of assessing to what extent children detect this structural condition (i.e. a contrast/discrepancy between what the speaker says and what he/she believes) usually precede tasks which focus on the comprehension of the pragmatic functions of irony.

The types of contrast and identity relationship which we considered in our study go beyond the patterns typically investigated in the literature, i.e. polarized statements applied to oppositely polarized situations, which in most cases consist of positive statements about negative situations. Indeed, as clarified in the previous section, various degrees of intermediacy were also included, both for the *statements* and the *situations*. Performance was tested both in terms of the correct recognition of an ironic versus a literal interpretation (assessed by means of a rating task, which in itself taps on a sort of implicit competence) and in terms of any explicit awareness that a relationship of identity versus contrast characterizes, respectively, literal and ironic interpretations. This latter was assessed by means of the *productive and meta-cognitive tasks* used in the second part of the study. Due to the fact that the tasks were quite difficult, we only considered children aged 12–15 years.

3.3 Sensitivity to the differences between various situations which lie in between two poles

We wondered whether children are able to discriminate between situations representing intermediate states which lie in between two poles (and which are not exemplars of either of the poles) and situations which lie in between two poles but which represent weakly polarized instances of those poles. This difference becomes obvious in the case of dimensions characterized by one of two different perceptual structures, namely, either consisting of two range poles and an intermediate point property (i.e. having a Range[poleA]-Point[intermediate]-Range[poleB] perceptual structure) or consisting of point poles and an intermediate range (i.e. having a Point[poleA]-Range[intermediates]-Point[poleB] perceptual structure). This classification emerged in previous works based on perceptual tasks (Bianchi et al. 2011b, 2013). In the present study, we focus on *top-bottom* and *horizontal-vertical* as examples of dimensions with a Point-Range-Point structure and *above-below* and *uphill-downhill* as examples of dimensions with a Range-Point-Range structure. The criterion used for the selection of these dimensions was based on the fact that they are familiar dimensions, their perceptual structure is unambiguous (based on Bianchi et al. 2011b) and they belong to the set of spatial dimensions used in a previous study on verbal irony (conducted with undergraduate students) which inspired the present study (Canestrari et al. In press; Cori et al. 2016).

A few examples will help to clarify the differences between the various types of intermediates that we are referring to. If participants give similar ratings to the statement relating to the scenarios i1 and i3 in Figure 1 and the statement relating to the scenarios i1 and i3 in Figure 3, this will indicate that they do not take into account the fact that the fireman, in Figure 3, is *neither at the top nor at the bottom* of the ladder (that is, i1 and i3 are two gradations of the intermediate state), while in Figure 1 the i1 and i3 scenarios show two gradations of the poles and do not represent the intermediate state, i.e. *neither uphill nor downhill*. The same difference holds for the other two stories we used (the fencer and the motorcyclists) which are reported in Appendix A [Online]. The main point is that there is only one single instance of the intermediate component (neither, nor) for the dimensions *uphill-downhill* and *in front of-behind*, while all of the instances which lie along the dimensions *at the top-at the bottom* and *vertical-horizontal* are instances of the intermediate component, with the exception of the two point extremes (which are in fact also the only instances of the poles).

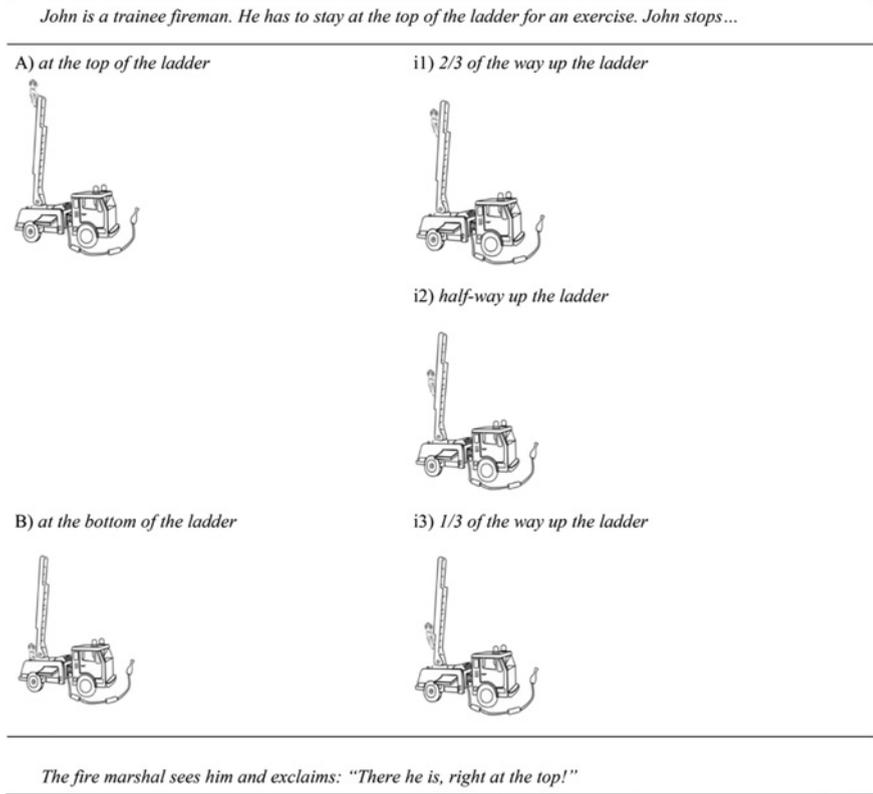


Figure 3: Examples of the different identity and contrast relationships between the situation and the statement in the experimental task with a polarized statement ("There he is, right at the top!"). This statement referred to a *similar strongly* (A) or *weakly* (i1) polarized situation, a *strongly opposite* (B) or *weakly opposite* (i3) polarized situation and to a situation showing an *intermediate, non-polarized, state* (i2).

In the present study, we did not explicitly ask participants to classify these target situations as intermediates or poles. We inferred their ability to notice any differences from the ratings they gave which revealed whether they had detected any contrast between the statement and the situation. Given a similar type of task as the one used in the present study adults would notice the difference between the situations shown in Figure 3(A) and 3(i1) and respond accordingly (Cori et al. 2016; Canestrari et al. In press). In this study, we aimed to establish whether in fact this difference is already understood at 12–15 years of age and whether this applies to both groups or only the group of gifted children.

4 Method

4.1 Participants

One hundred and one native speakers of Italian (age range: 12–15) participated in the study. They were divided into two groups based on their cognitive level (23 gifted, 17 M and 6 F, mean age 14.1, $ds = 1.1$; 78 non-gifted, 57 M and 21 F, mean age 13.7, $ds = 0.7$). This was assessed using the Italian version of the Wechsler Intelligence Scale of Children IV edition (Orsini et al. 2012) and the Standard Progressive Matrices of Raven (Raven et al. 2000). The students that obtained a score that is in the top 2% of the population (98^o percentile or more) were included in the gifted sample, while the others in the non-gifted group. In our sample, we excluded students with mental impairment, psychological disorders or learning disabilities. Parental consent was obtained for all participants. The study was approved by the ethical committee of the Department of Human Sciences of the University of Verona (Italy) and conforms to the ethical principles of the Declaration of Helsinki 2013.

4.2 Materials

Participants were presented with a booklet with a scenario, a drawing and a rating scale on each page. The scale ranged from 0 (= not ironic at all) to 10 (= maximally ironic). The stories had a similar structure: a context was set, an expectation was made explicit, then the situation was illustrated in an outline drawing and a statement relating to the expectation was reported.

The four stories in the first part of the booklet were all characterized by a polarized expectation and a consistent polarized statement. The two stories in the second part of the booklet were characterized by an intermediate expectation and a consistent intermediate statement. For each story, five different variations were presented. These varied in terms of the situation described and represented in the drawing, which progressively changed from one extreme to the opposite extreme. All the rest remained the same. The stories used are reported in Appendix A [Online].

The order of the stories and the order of the five variations of each story were randomized between participants. The two dimensions for the Range-Point-Range structure were: *uphill-downhill* (the story of the runners) and *in front of-behind* (the story of motorcyclists). The two dimensions selected for the Point-Range-Point structure were *at the top-at the bottom* (the story of the fireman) and

vertical-horizontal (the story of the fencer). As written texts were used, phonological and kinesic markers of irony were avoided (e.g. Ackerman 1983; Attardo 2000; Attardo et al. 2003) as were other ironic indexes such as hyperbole and *secondary interjections* (Ameka 1992 and, for example, “after all” as used by Burgers et al. 2012) which may prompt an ironic interpretation (Burgers et al. 2012). The final statements which were to be rated contained exclamation marks which were used to express emphasis in both ironic and non-ironic comments (Attardo 2000) and also *primary interjections* consisting of non-words, for example “Hmm” (Ameka 1992), in order to make the comments as natural as possible without explicitly eliciting an ironic interpretation.

4.3 Procedure

The participants took part in an individual rating task and a group production task. In the individual rating task, each participant received a booklet containing six stories and five variations for each story. The booklet had a total of 30 pages plus a cover with the instructions which asked participants to read each story and rate whether the final comment was ironic or not. We provided an 11-point scale (ranging from 0, not ironic at all, to 10, extremely ironic) for them to use for each story. The instructions were also verbally read out by the experimenter who – without giving any definition of irony – drew participants’ attention to the fact that being ironic does not only imply amusement but can also serve several pragmatic functions such as criticizing. An example of this was provided. No time limits were given but this first task was completed by all the participants within 20 minutes.

For the production task, participants were organized into groups of 3–4 individuals. They were asked to identify a “rule” that, in their opinion, could be applied to the stories which they rated as ironic. They were then requested to produce three brief scenarios containing irony which would fit in with the rule. It was made clear to them that the explanation (the rule) and the three scenarios provided as examples of the rule had to be agreed upon by all of the members of the group. The reason for choosing a group condition for the “explaining the rule” task and the production task is that groups have been shown to be the best context for successful reasoning (Augustinova et al. 2005; Augustinova 2008; Mercier and Sperber 2011; Pennington and Hastie 1993; Thompson et al. 2005) and for the production of accurate descriptions (e.g. Bozzi 1978; Bozzi and Martinuzzi 1989; Kubovy 2002). This has been explained as being due to the higher degree of social sharedness of information at group level which enables group members to engage in inductive or deductive reasoning using information that individuals working alone tend to ignore (e.g. Larson and Christensen 1993;

Wittenbaum and Stasser 1996; Tindale and Kameda 2000; Tindale et al. 2001). It has also been argued that groups are more likely to use counterfactual strategies (e.g. Augustinova 2008; Branchini et al. 2016).

4.4 Experimental design

Five independent variables were studied: Group (Gifted vs. Not gifted), Type of dimensions (PRP vs. RPR), Dimension (nested in Type), Statement (polarized on pole A vs. neither_nor NN) and Situation (five levels: A, i1, i2, i3, B).

4.5 Statistical analyses

Responses in the rating task were analyzed using Mixed-effect Models (Bates et al. 2015). Different models were used according to the nature of the dependent variable considered: Linear Mixed-effect model (LMM) for continuous variables, with Gaussian family and identity link functions, and Generalized Linear Mixed-effects models (GLMM) in the case of proportions (binomial family) or counts (Poisson family) and logit link functions. In all the analyses, Group (Gifted, Not Gifted), Type (PRP, RPR), Statement (polarizedA, neither_norNN) and Situation (A, i1, i2, i3, B) were entered in the model as Fixed Effects; Subjects and Dimensions (nested in Type) constituted random effects.

Mixed-effect Models made it possible to deal with the variability of some factors as random effects while dealing with the variability of other factors as fixed effects. Random effects are characterized by uninformative factor levels – if one of the levels of a variable were replaced by another level, the study would be essentially unchanged (Borenstein et al. 2009: 247). For the purposes of the hypotheses tested in our study, the Dimensions used in the experiment were simply exemplars of a general Type (i.e. PRP or RPR) and they were interchangeable with any other dimension of the same Type. Similarly, the participants in the study were simply schoolchildren who were either gifted or non-gifted but the results of our study may be generalized beyond these particular individuals. Conversely, fixed effects refer to the variables which we are specifically interested in; if one of the levels of those variables were replaced by another level, the study would be radically altered. The two Types of dimensions (PRP, RPR), the two Groups (gifted, non-gifted), the two types of statements (polarizedA, neither_norNN) and the 5 levels of Situation considered in our study (A, i1, i2, i3, B) were precisely the specific levels we wished to test in order to understand whether the participants' responses systematically varied depending on these various different levels.

In cases involving significant main effects or interactions, post-hoc tests using the Bonferroni correction were conducted and estimates (EST) were reported of the non-standardized size of the effect (EST indicates the mean difference for continuous dependent variables, the log rate ratio for counts, and the log odd ratio for proportions) and Cohen's index (d) as the standardized size of the effect (Lenth 2016; Kuznetsova et al. 2016; Cohen 1988).

Mixed Regression Assumptions (including the assumption that residuals are normally distributed and homoscedastic) were checked using Quantile-Comparison and residual diagnostic plots (Figures 4 and 7).

5 Results

5.1 Implicit knowledge

5.1.1 Analyses of the ratings

A first LMM was conducted on the ratings given by participants (ranging from 0 to 10) to study whether systematic differences emerged between the ironic value of a particular statement referring to various different situations. The assumptions of the mixed regression models were verified (see Figure 4). The goodness-of-fit of the LMM model was assessed using the conditional- R^2 index (Nakagawa and Schielzeth 2013); this was equal to 0.59.

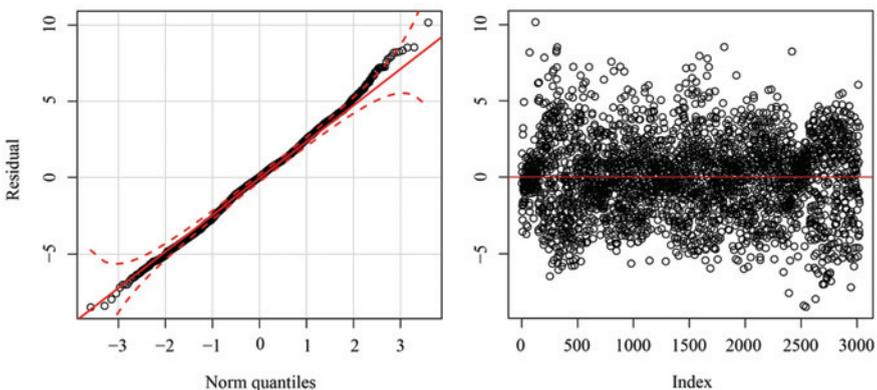


Figure 4: Diagnostic plots used for testing the mixed regression assumptions concerning the analysis of the ratings (LMM) as described in the main text.

A significant interaction between Statement and Situation emerged ($\chi^2_{(4, N=101)} = 529.06, p < 0.0001$) indicating that the ratings of irony attributed to the two types of statement considered in the experiment (polarized or intermediate) varied depending on the specific situation to which they were applied. In fact, as shown in Figure 5 (the graph on the left), there is a clear positive linear trend relating to irony ratings for a *polarized statement* which makes reference to pole A (e.g. “uphill”) starting with a situation with a clear instance of pole A (e.g. a path going up a steep hill) and progressing to the opposite pole B (e.g. a path going steeply downhill), with the statement referred to the opposite extreme being considered to be maximally ironic.

In the case of intermediate statements (e.g. “neither uphill nor downhill”), as shown in the graph on the right in Figure 5, the statement sounded most ironic when it was applied to the two extreme situations in which the statement and the situation were maximally contrasted (i.e. A, which in the example showed a path going steeply uphill and B, which in the example showed a path going steeply downhill). This statement was judged to be significantly less ironic when it was applied to the two situations i1 and i3 which lay in-between the extremes (Bonferroni post-hoc tests: A vs. i1: t ratio = 10.186, $p < 0.0001$, EST = 3.145, $d = 1.013$; B vs. i3: t ratio = 9.302, $p < 0.0001$, EST = 2.871, $d = 0.925$). The lowest ironic value was attributed

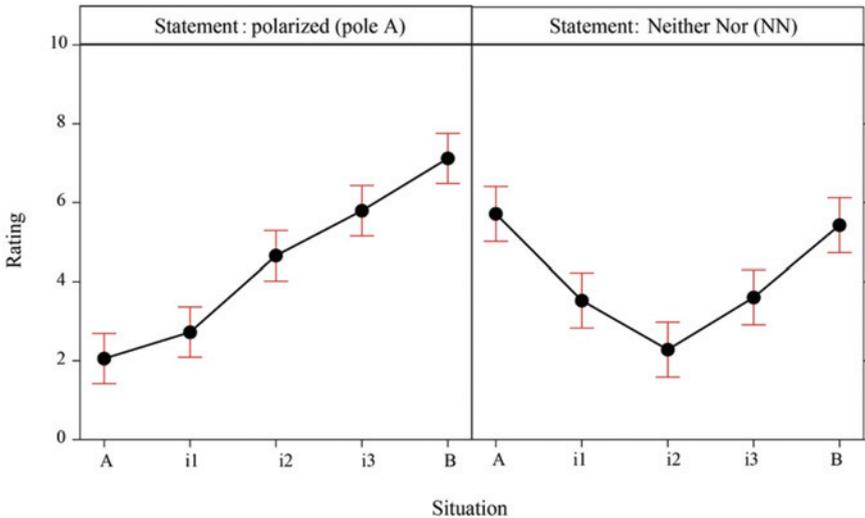


Figure 5: Fixed-effect plot of the interaction between Statement (polarized and intermediate) and Situation (with 5 variations of the scenarios considered from one extreme to the opposite extreme) with respect to the ratings of irony. The bars represent 95% confidence intervals.

when the situation represented a prototypical intermediate, i2 (Bonferroni post-hoc tests: A vs. i2: t ratio = 6.929, $p < 0.0001$, EST = 2.138, $d = 0.689$; B vs. i2: t ratio = 6.950, $p < 0.0001$, EST = 2.144, $d = 0.691$).

In general, the two patterns in Figure 5 correspond with those which emerged in a previous study carried out with adults (Cori et al. 2016; Canestrari et al. In press) except in the case of statement A when applied to situation A and statement NN when applied to situation i2. In these instances, adults rated the statement as not being ironic at all while the children seemed to perceive a slightly ironic interpretation with an average rating of around 2 as compared to around zero for adults.

The significant interaction between Statement, Situation and Group ($\chi^2_{(4, N=101)} = 186.341$, $p < 0.0001$) confirmed that gifted children behave in a similar way to adults while non-gifted children do not. In Figure 6, the responses of the two groups of participants are plotted separately. As a comparison between the graphs in the top rows (not gifted) and bottom rows (gifted) makes clear, the trend of responses is similar but the lines relating to non-gifted participants are flatter. This holds for both types of statements (polarized and intermediate).

In the most typical condition, i.e. a *polarized statement*, the responses provided by the gifted children correspond to those of adults (Cori et al. 2016; Canestrari et al. In press): they recognized that irony increases progressively as the contrast between the statement and the situation increases and that the statement is not ironic at all when the contrast is null. Conversely, non-gifted participants underestimated the ironic interpretation of the polarized statements when they applied to oppositely polarized situations, i.e. B (Bonferroni post hoc tests: B_gifted vs. B_not gifted: t ratio = 5.920, $p < 0.0001$, EST = 2.843, $d = 0.589$) while at the same time overestimating the degree of irony in a statement when it applied to a corresponding situation, i.e. A (Bonferroni post hoc tests: A_gifted vs. A_not gifted: t ratio = -4.512, $p < 0.002$, EST = -2.167, $d = -0.448$). Indeed, the non-gifted children did not attribute a literal meaning to the statements in these cases (i.e. a zero rating) but instead judged them to be weakly ironic ($M_{A_not\ gifted} = 2.553$; $SD = 3.220$). In other words, the ratings given by the non-gifted participants in the study suggest that they are less able to discriminate clearly between the various conditions.

A similar conclusion can be reached when the responses for *intermediate statements* are considered. The trend is comparable in that non-gifted participants recognized that the intermediate statements were significantly more ironic when applied to clearly polarized situations (A and B) as compared to prototypically intermediate situations i2 (Bonferroni post hoc: not-gifted_A vs not-gifted_i2: t ratio = 6.328, $p < 0.0001$, EST = 1.872, $d = 0.629$; not-gifted_B vs not-gifted_i2: t ratio = 5.322, $p < 0.0001$, EST = 1.574, $d = 0.529$). However, the distance

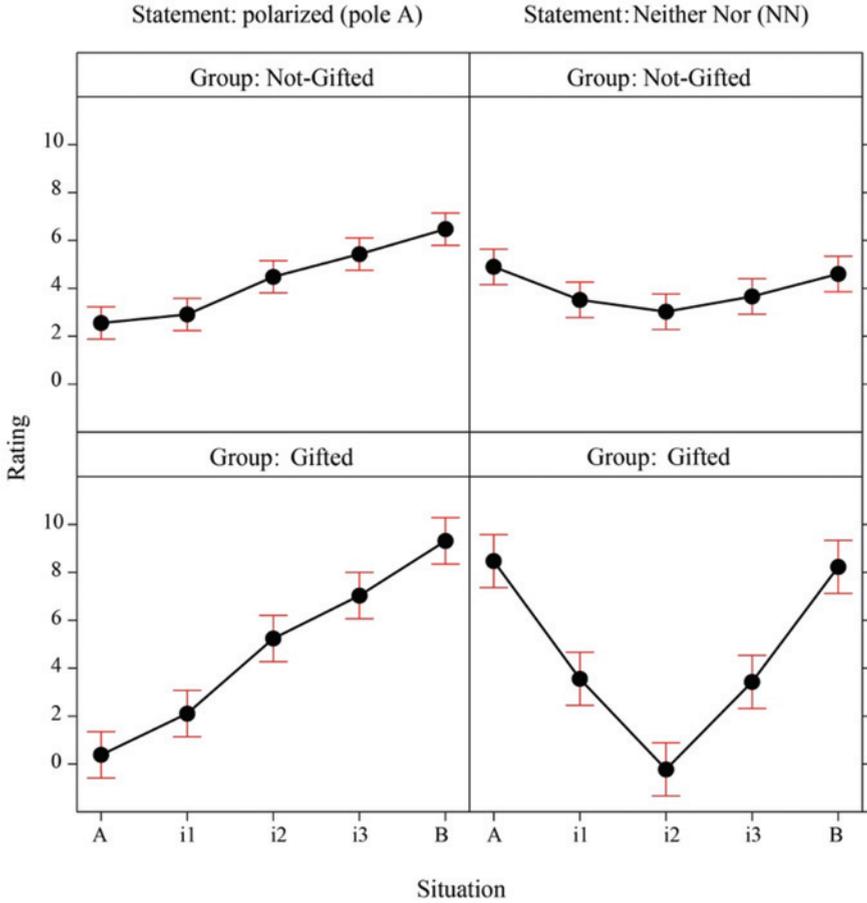


Figure 6: Fixed-effects plot of the interaction between Statement (polarized and intermediate), Group (gifted and not gifted) and Situation (with 5 variations of the scenarios considered, from one extreme to the opposite extreme) with respect to the ratings of irony. The bars represent 95% confidence intervals.

between the ratings given in the maximally contrasting situations and the minimally contrasting situations is much reduced for non-gifted children as compared to gifted. This is due either to the fact that in conditions of maximum contrast, i.e. A and B, they rated the statements as being less ironic than gifted participants (Bonferroni post hoc: not-gifted_A vs gifted_A: t ratio = -6.328, $p < 0.0001$, EST = -1.872, $d = -0.629$; not-gifted_B vs gifted_B: t ratio = -6.361, $p < 0.0001$, EST = -3.634, $d = -0.632$) or to the fact that they judged intermediate statements applied to prototypical intermediate situations as being slightly

ironic in contrast to the gifted children who rated them as not ironic at all (Bonferroni post hoc: not-gifted_i2 vs gifted_i2: t ratio = 5.688, $p < 0.0001$, EST = 3.247, $d = 0.566$). In fact, non-gifted participants gave ratings to the typical intermediate conditions (i2) which did not differ from the two adjacent conditions, i1 and i3 (Bonferroni post hoc not gifted: i1 vs i2, t ratio = 1.675, $p = 1.000$, EST = 0.494, $d = 0.16$; i3 vs i2, t ratio = 2.159, $p = 1.000$, EST = 0.636, $d = 0.214$). In contrast, gifted participants were clearly able to discriminate between the varying degrees of irony associated with the 5 different situations (all Bonferroni post hoc tests are significant by $p < 0.0001$).

There was a further difference between the performance of the two groups which supports the claim that gifted children perform in a way which is similar to adults: the gifted children attributed a similar degree of irony to typical conditions involving *polarized statements* applied to oppositely polarized situations ($M_{\text{rating polarized statement}_B} = 9.315$, $SD = 1.734$) and *intermediate statements* applied to polarized situations ($M_{\text{rating statement}_{NN}_B} = 8.456$, $SD = 1.917$; $M_{\text{rating statement}_{NN}_A} = 8.695$, $SD = 1.617$). As post hoc tests confirmed, there is no significant difference between these ratings. Conversely, non-gifted participants attributed more irony to conditions involving *polarized statements applied to oppositely polarized situations* than to *intermediate statements* applied to *polarized situations* (Bonferroni post hoc not gifted: PolarizedStatement_situationB vs NNstatement_situationA: t ratio = 5.989, $p < 0.0001$, EST = 2.282, $d = 0.595$; PolarizedStatement_situationB vs NNstatement_situationB: t ratio = 7.119, $p < 0.0001$, EST = 3.989, $d = 0.706$).

Neither of the two groups in our study, however, turned out to be sensitive to the different perceptual structure of the dimensions considered, i.e. Point-Range-Point and Range-Point-Range (the interaction between Group*Type*Statement*Situation did not turn out to be significant: $\chi^2_{(4, N=101)} = 2.982$, $p = 0.560$). This is in any case a subtle difference and even gifted children do not seem to pick it up at this age.

5.1.2 Performance of the two groups (gifted, not gifted) in terms of the number of errors

Another way to study the performance of the two groups is to consider how many times participants judged ironic statements to be non-ironic (i.e. when there was a clear contrast between the statement and the situation) to be non-ironic or vice versa the number of times when there was no contrast between the statement and the situation and they judged non-ironic statements to be ironic, i.e. their rating was incorrect in the sense that it was in contrast with what might be expected.

Responses to the rating task were thus re-coded in terms of whether they were correct or incorrect based on the above-mentioned criterion. We focused specifically on those conditions that could be considered as clearly unambiguous, i.e. with a maximum contrast between the statement and the situation (polarized statements referring to maximally contrasting situations, B, and intermediate statements referring to maximally contrasting situations, A and B) and those involving an absence of contrast, i.e. with an identity relationship between the statement and the situation – i.e. polarized statements applied to situation A and intermediate statements applied to situation i2. We re-coded as “correct” the responses that attributed any degree of irony (from 1 to 10) in the conditions of maximum contrast and those that attributed zero irony in the conditions of null contrast. We then performed a GLMM on this new data, after having verified the assumptions (see Figure 7) and the goodness-of-fit of the model used using conditional- R^2 (which was equal to 0.51).

The dependent variable used in this analysis was the proportion of correct responses over the total of responses. Statement (polarized, intermediate), Relationship between statement and situation (identity, contrast) nested in statement, Group (gifted, not gifted) and Type of dimension (PGP, GPG) were the fixed effects; Dimension (nested in Type) constituted the random effect

Two effects turned out to be significant: Group ($\chi^2_{(1, N=101)} = 15.831$, $p < 0.0001$), indicating that the gifted participants were more frequently correct than the non-gifted participants, and the interaction between Statement, Relationship and Group ($\chi^2_{(1, N=101)} = 5.804$, $p = 0.05$). As shown by the plots on the right in Figure 8, this interaction indicates that in the case of intermediate

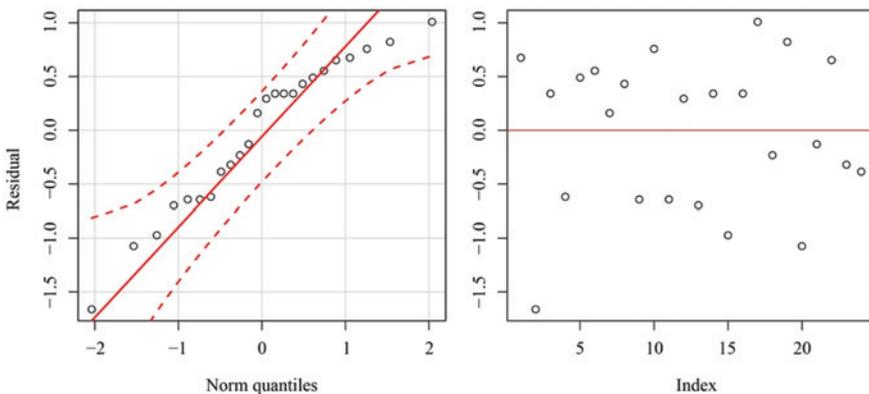


Figure 7: Diagnostic plots used for testing the mixed regression assumptions concerning the analysis of the proportion of correct responses (GLMM) as described in the main text.

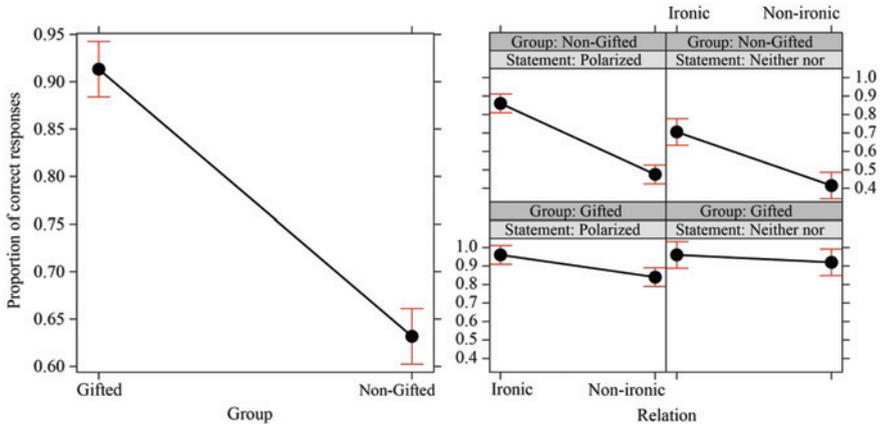


Figure 8: Graph on the left: plot showing the effect of Group (gifted and non-gifted) on the proportion of correct responses. Graphs on the right: plot showing the effect of the interaction between Relation (ironic, non-ironic), Statement (polarized and intermediate) and Group (gifted and non-gifted) on the proportion of correct responses. The bars represent 95 % confidence intervals.

statements, gifted children performed better than non-gifted children in terms of recognizing both ironic (NNstatement_ironic: gifted vs. non-gifted: t ratio = 5.793, $p = 0.011$, EST = 0.255, $d = 0.576$) and non-ironic interpretations (NNstatement_Non-ironic: gifted vs. non-gifted: t ratio = 11.473, $p < 0.001$, EST = 0.505, $d = 1.141$). Conversely, when polarized statements were concerned, the difference between the two groups only concerned whether or not they recognized the non-ironic interpretation (PolarizedStatement_ironic: gifted vs. non-gifted: t ratio = 3.213, $p = 0.346$; PolarizedStatement_Non-ironic: gifted vs. non-gifted: t ratio = 11.727, $p < 0.001$, EST = 0.365, $d = 1.116$).

Indeed, as shown in Table 1, while at least 84 % of the responses of the gifted participants were correct in all conditions, even the non-gifted children performed quite well when it came to recognizing ironic interpretations when a situation involving a contrast was concerned, both with polarized (86 %) and intermediate statements (70 %). However, their success rate dropped to 41 % when it was a case of recognizing non-ironic interpretations relating to intermediate statements.

These results suggest, firstly, that at 12–15 years of age children are able to detect irony in a statement, not only in typical conditions (with a contrast between a polarized statement and an oppositely polarized situation) but also when the contrast is subtler, e.g. between an intermediate statement and a polarized situation. This is a new aspect which adds to previous literature on the development of the understanding of irony in children. Secondly, it suggests that the ability to

Table 1: Proportion of correct responses given by the two groups.

Statement	Group	Relation (between statement and situation)	Proportion (mean) of correct responses	Sd
Polarized A	Gifted	Contrast (ironic)	0.960	0.049
		Identity (non-ironic)	0.840	0.055
	Non-gifted	Contrast (ironic)	0.860	0.057
		Identity (non-ironic)	0.475	0.066
Intermediate NN	Gifted	Contrast (ironic)	0.960	0.125
		Identity (non-ironic)	0.920	0.137
	Non-gifted	Contrast (ironic)	0.705	0.129
		Identity (non-ironic)	0.415	0.131

detect irony in standard conditions (polarized statement applied to oppositely polarized situation) is not an effective cue for giftedness. The ability to discriminate between literal and ironic statements seems to be a better predictor, both in more typical conditions (i.e. of polarized statement applied to polarized situation) and in less typical scenarios (i.e. when intermediate statements are applied to polarized situation). We will go back to this in the final discussion.

5.2 Explicit knowledge

The second part of the task allowed us to collect information concerning which “rule” participants thought applied to statements that they rated as ironic and concerning their ability to create new scenarios which epitomize that rule. As specified in the methods section, this part of the task was conducted with groups of 3–4 participants. The following data resulted from tasks carried out by six groups of gifted participants and 21 groups of non-gifted participants. Also in this case, there was a clear difference between the two groups of participants.

5.2.1 The ability to explain what characterized the statements to which irony was attributed (identification of the “rule”)

The explanations provided by the groups were classified by two independent judges into various categories based on the kind of explanation given, i.e.:

underlying contrast (between the statement and the situation, e.g. “The statement should contrast with the situation”, or between the statement and what the speaker really means, e.g. “The statement should describe something which is opposite to what the speaker really means”, or between the statement and the speaker’s expectation, e.g. “The statement should describe something which is opposite to what the speaker expects”); pragmatic factors (e.g. “an ironic statement is usually characterized by a particular tone of voice” or “irony is supposed to be humorous rather than offensive”); faking (e.g. “the speaker does not really think what he/she says in the the statement”); double meaning (“what is meant is not what is said”); partial truth (“the sentence says something which is only partially true”); no idea (“I don’t know what the rule is”); wrong explanations (if, for instance, they referred to aspects related to humor in general and not specifically to irony) or missing responses. Both judges classified all of the responses. The inter-rater agreement was very good (Cohen’s $\kappa=0.915$, $SE=0.031$; in the very few cases where the initial classifications done by the two judges did not match, a discussion took place and a final agreement was always reached).

According to these categories, a GLMM was conducted on the responses of the two groups of participants. A significant interaction between Groups and Response category emerged ($\chi^2_{(7, N=27)}=16.029$, $p=0.02$). All of the groups of gifted participants referred to the presence of an underlying contrast (and one of the six groups also mentioned a pragmatic-communicative factor) whereas only 40% of the responses produced by the non-gifted participants mentioned the presence of an opposition/contrast (post hoc test Contrast_gifted vs Contrast_not-gifted: $EST=0.523$, $SE=0.144$, $t=3.633$, $p=0.042$, $d=0.699$). In the same percentage of cases (40%), the explanations given by the non-gifted participants made reference to pragmatic factors (e.g. the tone of voice or the clear intention to be humorous) or to the presence of a double meaning or partial truth; four groups (20%) explicitly admitted that they could not work out the rule or that they were in any case unable to offer an explanation. In general, what the results revealed was not that non-gifted children lack any idea of what characterizes irony, but the fact that the explanations they offered did not specifically recognize the presence of contrast as an essential and specific component.

5.2.2 Production of new short stories to exemplify the “rule” for irony

The final part of the task required each of the groups to produce three different short stories which fit in with the “rule” they had identified. A GLMM (binomial

family) was conducted on the proportion of correct, incorrect and missing stories for each of the two samples of participants (the classification of responses in the three categories was done by two independent judges, Cohen's $\kappa = 0.914$, $SE = 0.028$). Here too there were differences in the performance of the two groups ($\chi^2_{(2, N=27)} = 17.207$, $p = 0.0001$). Gifted participants produced a significantly higher number of correct stories as compared to the non-gifted participants ($EST = 0.563$, $SE = 0.165$, $t = 3.411$, $p = 0.015$, $d = 0.656$). Indeed, the gifted participants produced 89% of the total number of stories expected (i.e. 16 out of 18 – there were only two stories missing) and the stories produced were all correct examples of irony. They generally involved ironic criticisms. Conversely, the non-gifted participants produced only 20% of correct stories (i.e. 13 out of 63 expected); 48% (i.e. 30 out of 63) of the stories produced were incorrect, being simply humorous (such as jokes or riddles) rather than ironic and 32% were missing (i.e. 20 out of 63).

The fact that there were fewer correct stories associated with the non-gifted group seems consistent with the lack of clarity characterizing the “rules” they had identified in the previous phase. We tested whether the ability to explain irony in terms of a “contrast” (i.e. to identify the “rule”) predicted the ability to produce correct stories by conducting a GLMM (Poisson family) on the number of correct stories invented, with Groups (gifted, non-gifted) and Identification of the Contrast rule (yes, no) as predictors. A main effect emerged for Contrast ($\chi^2_{(1, N=27)} = 7.351$, $p = 0.006$). This finding indicates that, for both gifted and non-gifted participants, identifying contrast as the rule in effect predicted the ability to produce ironic comments ($EST = 1.332$, $SE = 0.607$; $z = 2.194$, $p = 0.028$; $d = 0.422$).

6 Discussion

The aim of this study was to investigate typically developing and gifted children's ability to understand three different forms of verbal irony: those based on clearly polarized contrasts, expressed by a polarized comment referring to an oppositely polarized situation; those involving modulations of this contrast, i.e. when polarized comments refer to weakly polarized situations and lastly those consisting of verbal irony involving intermediates, i.e. when an intermediate comment refers to a polarized situation or a polarized comment refers to an intermediate situation. We assumed that the third type of irony would be more difficult to understand than the other two given that it belongs to the category of implicitly evaluative irony since the intended meaning cannot be inferred by

searching for a semantic opposite (Burgers et al. 2012). We used recognition and production tasks in order to assess the participants' implicit and explicit knowledge of verbal irony. We found that gifted children performed better than their typically developing peers in terms of their understanding of the three types of verbal irony, their ability to explain the general rules applying to verbal irony and their ability to produce scenarios containing irony.

These findings are in line with expectations based on the general literature on giftedness, i.e. that gifted children are a step forward from their non-gifted peers in various cognitive abilities, including understanding humor and figurative language (as revised in Section 1). They are also in agreement with the more informal consensus view of parents and teachers who note that gifted children are more inclined to use irony and humor than their peers (e.g. Bergen 2009; Hoh 2005; Ziv and Gadish 1990).

The analysis we made of correct and incorrect responses in the recognition task showed that gifted children are better than their typically developing peers not only at detecting verbal irony when there is contrast between a comment and a situation but also at identifying non-ironic comments. The fact that some literal comments were rated as ironic by the group of typically developing children in our study is similar to the findings of Dews et al. (1996) in their study of 5–6 and 7–8 year olds. In both cases, literal comments were perceived as ironic and humorous, even though no contrast or incongruity was present. The authors referred to this phenomenon as a sort of “halo effect” (1996: 3077) between what is nice (i.e. a compliment) and what is funny (i.e. humor).

Moreover, our results proved that both in the more canonical condition (i.e. involving polarized statements) and when irony was based on intermediate comments, the degree of irony assigned by gifted children to variously contrasting situations were very similar to the ratings assigned by adults to the same stimuli (Canestrari et al. In press; Cori et al. 2016). This is consistent with two facts discussed in the introductory sections (Sections 1 and 2): (1) that the cognitive development of gifted children is accelerated in comparison with their typically developing peers and they tend to reach later evolutive steps well in advance (Bergen 2009, 2014; Bernstein 1986; Cukierkorn et al. 2008; Gross 1999; Hoh 2005; Holt and Holt 1995; Klavir and Gorodetsky 2001; Pieternel et al. 2011; Shade 1991; Sharifi and Sharifi 2014; Ziv and Gadish 1990) and (2) the ability to understand and produce verbal irony increases with age and continues to develop through late childhood in typically developing children and is fully acquired by adulthood (see Section 2).

The disparity between the two groups in our study emerged not only in the recognition task but also in the production task when children were asked to

explain the underlying rule for a comment to be understood as ironic and when they were requested to invent ironic scenarios. The non-gifted children proved to be less aware than their gifted peers of the structural aspects of verbal irony. In fact, the necessary presence of a contrast as a structural feature of verbal irony was identified in only 40% of the cases with non-gifted children versus 100% with gifted children. Moreover, gifted children were better at inventing stories containing irony. The non-gifted participants came up with a smaller number of scenarios and in most cases produced humorous stories, such as jokes or riddles, rather than ironic stories. This tendency to produce humorous rather than ironic stories complies with their frequent failure to identify the “rule” underlying irony and demonstrates that the concept of irony is often confused with humor – a phenomenon which is adjacent but different (e.g. Dynel 2014; Gibbs et al. 2014). This finding contributes to the rather sparse amount of information available regarding the production of irony in children (Pexman et al. 2009).

Overall our results suggest that the cognitive abilities relating to the understanding and producing verbal irony are potentially useful in terms of assessing the development of cognitive capacity and giftedness. The present is a pioneer study and it has various limitations and further experimentation is needed to confirm the results and/or extend them in various directions. For example, studies on verbal irony comprehension in children often make use of belief questions regarding the intentions and attitudes of the speaker in order to ascertain whether they understand the ironic value even when they do not have an explicit idea about the rules underlying irony (e.g. Angeleri and Airenti 2014; Banasik 2013; Bosco and Bucciarelli 2008; Burnett 2015; Filippova and Astington 2008, 2010; Loukusa and Leinonen 2008; Pexman and Glenwright 2007; Pexman et al. 2005). Since many of the non-gifted children who participated in our study were confused about the salient features of verbal irony when their explicit knowledge was assessed, belief questions regarding the speaker’s intentions and attitude might be useful and would in any case enrich future experimental research on the topic. Moreover, we deliberately disregarded the pragmatic aspects of verbal irony. This was because – as we emphasized in the literature review in Section 2 – understanding verbal irony means first of all detecting a discrepancy between a comment and the referent situation and, secondly, understanding *the reasons* why people make this type of comment rather than a literal one. Our study focused on the former aspect, but it might be interesting for future investigations to analyze the latter issue as it may be relevant in terms of assessing giftedness. Moreover, it had been assumed, in this study, that understanding intermediate verbal irony would be more difficult as compared to irony based

on a contrast of kind or of magnitude (to use Colston and O'Brien's expressions 2000a) and indeed the results showed that the gifted participants understood the former better than the non-gifted participants. The levels of complexity of implicitly evaluative irony could also be operationalized, however, in different ways. For example, "Oh Tuscany in May!" said by a speaker who expects good weather and instead finds horrible weather (Wilson and Sperber 1992) prefigures a contrast between two opposite poles (i.e. good and horrible weather), but the contrast must be inferred. This is another case of implicit evaluative irony which one would expect to be more complex than the explicit evaluative ironic version "What great weather!" (see Burgers et al. 2012). However, the kind of cognitive abilities which are needed in order to understand this type of comment seem rather different from those involved in understanding intermediate irony. In the former case, encyclopedic knowledge is needed (one has to know where Tuscany is and what the weather is like in that region) in addition to being able to make a logical inference. In the latter case, since both the poles and the intermediate region are perceptually accessible, the kind of cognitive ability involved in understanding the sentence as ironic has more to do with the ability to interpret a discrepancy in terms of contrast (i.e. sensitivity to contrast) rather than with the ability of making a logical inference or possessing specific knowledge. All these considerations, in addition to considerations regarding the length of the inferential chain (Bosco and Bucciarelli 2008) and the distinction between implicitly versus explicitly evaluative irony (Burgers et al. 2012) might provide further information concerning the competence of gifted individuals and their mastery in terms of understanding and producing irony. Finally, the emotional impact of verbal irony on children is another interesting aspect to be considered (Nicholson et al. 2013) as this would surely provide a fuller understanding of how verbal irony is perceived by gifted and non-gifted children.

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References

- Ackerman, B. P. 1982. Contextual integration and utterance interpretation: The ability of children and adults to interpret sarcastic utterances. *Child Development* 53. 1075–1083. doi:10.1111/j.1467-8624.1982.tb01373.x.
- Ackerman, B. P. 1983. Form and function in children's understanding of ironic utterances. *Journal of Experimental Child Psychology* 35(3). 487–508. doi:10.1016/0022-0965(83)90023-1.
- Akimoto, Y, S. Miyazawa & T. Muramoto. 2012. Comprehension processes of verbal irony: The effects of salience, egocentric context and allocentric theory of mind. *Metaphor & Symbol* 27. 217–242. doi:10.1080/10926488.2012.691750.
- Ameke, F. 1992. Interjections: The universal yet neglected part of speech. *Journal of Pragmatics* 18. 101–118. doi:10.1016/0378-2166(92)90048-G.
- Angeleri, R & G. Airenti. 2014. The development of joke and irony understanding: A study with 3- to 6-year-old children. *Canadian Journal of Experimental Psychology* 68(2). 133–146. doi:10.1037/cep0000011.
- Attardo, S. 2000. Irony markers and functions: Towards a goal-oriented theory of irony and its processing. *Rask* 12. 3–20.
- Attardo, S., J. Eisterhold, J. Hay & I. Poggi. 2003. Multimodal markers of irony and sarcasm. *Humor. International Journal of Humor Research* 16(2). 243–260. doi:10.1515/humr.2003.012.
- Augustinova, M. 2008. Falsification cueing in collective reasoning: Example of Wason selection task. *European Journal of Social Psychology* 38. 770–785. doi:10.1002/ejsp.532.
- Augustinova, M., D. Oberlé & G. L. Stasser. 2005. Differential access to information and anticipated group interaction: Impact on individual reasoning. *Journal of Personality and Social Psychology* 88. 619–631. doi:10.1037/0022-3514.88.4.619.
- Banasik, N. 2013. Non-literal speech comprehension in preschool children- An example from a study on verbal irony. *Psychology of Language and Communication* 17(3). 309–323. doi:10.2478/plc-2013-0020.
- Bates, D., M. Maechler, B. Bolker & S. Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1–48. doi:10.18637/jss.v067.i01.
- Bergen, D. 2009. Gifted children's humor preferences, sense of humor, and comprehension of riddles. *Humor. International Journal of Humor Research* 22(4). 419–436. doi:10.1515/HUMR.2009.024.
- Bergen, D. 2014. Children's humor and giftedness. In S. Attardo (ed.), *Encyclopedia of humor studies*, 120–121. Washington DC: Sage Publications.
- Bernstein, D. 1986. The development of humor: Implications for assessment and interventions. *Topics and language Disorders* 6. 65–71. doi:10.1097/00011363-198609000-00008.
- Bianchi, I., R. Burro, S. Torquati & U. Savardi. 2013. The middle of the road: Perceiving intermediates. *Acta Psychologica* 144(1). 121–135. doi:10.1016/j.actpsy.2013.05.005.
- Bianchi, I., U. Savardi, R. Burro & S. Torquati. 2011a. Negation and psychological dimensions. *Journal of Cognitive Psychology* 23. 275–301. doi:10.1080/20445911.2011.493154.
- Bianchi, I., U. Savardi & M. Kubovy. 2011b. Dimensions and their poles: A metric and topological approach to opposites. *Language and Cognitive Processes* 26. 1232–1265. doi:10.1080/01690965.2010.520943.

- Borenstein, M., L. V. Hedges, J. Higgins & H. R. Rothstein. 2009. Random-effects model. In *Introduction to Meta-analysis*, 69–75. Chichester: Wiley.
- Bosco, F. M. & M. Bucciarelli. 2008. Simple and complex deceptions and ironies. *Journal of Pragmatics* 40(4). 583–607. doi:10.1016/j.pragma.2007.05.004.
- Bozzi, P. 1978. L'interosservazione come metodo per la fenomenologia sperimentale [Interobservation as method for the experimental phenomenology]. *Giornale Italiano di Psicologia* 5. 229–239.
- Bozzi, P. & L. Martinuzzi. 1989. Un esperimento di interosservazione [An inter-observational experiment]. *Rivista di Psicologia* 1. 1–46.
- Branchini, E., I. Bianchi, R. Burro, E. Capitani & U. Savardi. 2016. Can Contraries Prompt Intuition in Insight Problem Solving?. *Frontiers in Psychology* 7. 1962. doi:10.3389/fpsyg.2016.01962.
- Burgers, C., M. Van Mulken & P. J. Schellens. 2012. Type of evaluation and marking of irony: The role of perceived complexity and comprehension. *Journal of Pragmatics* 44(3). 231–242. doi:10.1016/j.pragma.2011.11.003.
- Burnett, D. L. 2015. Exploring the role of conventionality in children's interpretation of ironic remarks. *Journal of Child Language* 42(6). 1–22. doi:10.1017/S0305000914000798.
- Calmus, A. & S. Caillies. 2014. Verbal irony processing: How do contrast and humour correlate?. *International Journal of Psychology* 49(1). 46–50. doi:10.1002/ijop.12003.
- Canestrari, C. & I. Bianchi. In press. Perceptual opposites and the modulation of contrast in irony. *Review of Cognitive Linguistics*.
- Canestrari, C., I. Bianchi & V. Cori. In press. De-polarizing verbal irony. *Journal of Cognitive Psychology*.
- Chung, D., K. Yun, J. H. Kim, B. Jang & J. Jeong. 2011. [Different gain/loss sensitivity and social adaptation ability in gifted adolescents during a public goods game](#). *PLoS ONE* 6(2). e17044. doi:10.1371/journal.pone.0017044.
- Cohen, J. 1988. *Statistical power analysis for the behavioral sciences*, 2nd edn. New York: Academic Press.
- Colston, H. L. 2002. Contrast and assimilation in verbal irony. *Journal of Pragmatics* 34. 111–142. doi:10.1016/S0378-2166(02)80008-X.
- Colston, H. L. & J. O'Brien. 2000a. Contrast of kind versus contrast of magnitude: The pragmatic of accomplishments of irony and hyperbole. *Discourse Processes* 30(2). 179–199. doi:10.1207/S15326950DP3002_05.
- Colston, H. L. & J. O'Brien. 2000b. Contrast and pragmatics in figurative language. Anything understatement can do, irony can do better. *Journal of Pragmatics* 32. 1557–1583. doi:10.1016/S0378-2166(99)00110-1.
- Cori, V., C. Canestrari & I. Bianchi. 2016. The perception of contrariety and the processing of verbal irony. *Gestalt Theory – An International Multidisciplinary Journal* 38(2-3). 253–266.
- Creusere, M. 2000. A developmental test of theoretical perspectives on the understanding of verbal irony: Children's recognition of allusion and pragmatic insincerity. *Metaphor and Symbol* 15. 29–45. doi:10.1080/10926488.2000.9678863.
- Cukierkorn, J. R., F. A. Karnes, S. J. Manning, H. Houston & K. Besnoy. 2008. Recognizing giftedness: Defining high ability in young children. *Dimensions of Early Childhood* 36(2). 3–13.
- Dews, S., J. Caplan & E. Winner. 1995. [Why not say it directly? The social functions of irony](#). *Discourse Processes* 19. 347–367. doi:10.1080/01638539509544922.

- Dews, S., H. Winner, J. Kaplan, E. Rosenblatt, M. Hunt, K. Lim & B. Smarsh. 1996. Children's understanding of the meaning and functions of verbal irony. *Child Development* 67. 3071–3085. doi:10.2307/1131767.
- Dynel, M. 2014. Isn't it ironic? Defining the scope of humorous irony. *Humor. International Journal of Humor Research* 27(4). 619–639. doi:10.1515/humor-2014-0096.
- Filippova, E. & J. W. Astington. 2008. Further development in social reasoning revealed in discourse irony understanding. *Child Development* 79. 126–138. doi:10.1111/j.1467-8624.2007.01115.x.
- Filippova, E. & J. W. Astington. 2010. Children's understanding of social-cognitive and social-communicative aspects of discourse irony. *Child Development* 81(3). 913–928. doi:10.1111/j.1467-8624.2010.01442.x.
- Gibbs, R. W. 2000. Irony in talk among friends. *Metaphor and Symbol* 15(1–2). 5–27. doi:10.1080/10926488.2000.9678862.
- Gibbs, R. W., Jr., G. A. Bryant & H. L. Colston. 2014. Where is the humor in verbal irony?. *Humor. International Journal of Humor Research* 27(4). 575–595. doi:10.1515/humor-2014-0106.
- Giora, R. 1995. On irony and negation. *Discourse Processes* 19(2). 239–264. doi:10.1080/01638539509544916.
- Giora, R., O. Fein, J. Ganzi, N. A. Levi & H. Sabah. 2005. On negation as mitigation: The case of negative irony. *Discourse Processes* 39(1). 81–100. doi:10.1207/s15326950dp3901_3.
- Giora, R., S. Givoni & O. Fein. 2015. Defaultness reigns: The case of sarcasm. *Metaphor and Symbol* 30(4). 290–313. doi:10.1080/10926488.2015.1074804.
- Giora, R., S. Givoni, V. Heruti & O. Fein. 2017. The role of defaultness in affecting pleasure: The optimal innovation hypothesis revisited. *Metaphor and Symbol* 32(1). 1–18. doi:10.1080/10926488.2017.1272934.
- Glenwright, M., J. M. Parackel, K. J. Cheung & E. Nilsen. 2013. Intonation influences how children and adults interpret sarcasm. *Journal of Child Language* 41(2). 472–484. doi:10.1017/S0305000912000773.
- Glenwright, M. & P. M. Pexman. 2010. Development of children's ability to distinguish sarcasm and verbal irony. *Journal of Child Language* 37. 429–451. doi:10.1017/S0305000909009520.
- Gottfredson, L. S. 1997. Why g matters: The complexity of everyday life. *Intelligence* 24(1). 79–132. doi:10.1016/S0160-2896(97)90014-3.
- Gross, M. 1999. Small poppies: Highly gifted children in the early years. *Roeper Review* 21(3). 207–214. doi:10.1080/02783199909553963.
- Hancock, J. T., P. J. Dunham & K. Purdy. 2000. Children's comprehension of critical and complimentary forms of verbal irony. *Journal of Cognition and Development* 1(2). 227–248. doi:10.1207/S15327647JCD010204.
- Harris, M. & P. M. Pexman. 2003. Children's perception of the social functions of verbal irony. *Discourse Processes* 36(3). 147–165. doi:10.1207/S15326950DP3603_1.
- Haverkate, H. 1990. A speech act analysis of irony. *Journal of Pragmatics* 14. 77–109. doi:10.1016/0378-2166(90)90065-L.
- Herrero Ruiz, J. 2009. *Understanding tropes. At the crossroads between pragmatics and cognition*. Frankfurt am Main: Peter Lang.
- Hoh, P. S. 2005. The linguistic advantage of the intellectually gifted child: An empirical study of spontaneous speech. *Roeper Review* 27(3). 178–185. doi:10.1080/02783190509554313.

- Holt, D. G. & C. W. Holt. 1995. An exploration of the relationship between humor and giftedness in students. *Humor. International Journal of Humor Research* 8(3). 257–271. doi:10.1515/humr.1995.8.3.257.
- Jacob, H., B. Kreifelts, S. Nizielski, A. Schütz & D. Wildgruber. 2016. Effects of emotional intelligence on the impression of irony created by the mismatch between verbal and nonverbal cues. *PLoS ONE* 11(10). e0163211. doi:10.1371/journal.pone.0163211.
- Klavir, R. & M. Gorodetsky. 2001. The processing of analogous problems in the verbal and visual-humorous (cartoons) modalities by gifted/average children. *Gifted Child Quarterly* 45(3). 205–215. doi:10.1177/001698620104500305.
- Kubovy, M. 2002. Phenomenology, cognitive. In L. Nadel (ed.), *Encyclopedia of cognitive science*, 579–586. London, UK: Nature Publishing Group.
- Kuznetsova, A., B. P. Bruun & B. C. R. Haubo. 2016. lmerTest: Tests in linear mixed effects models. *R package version 2.0-32*, <https://CRAN.R-project.org/package=lmerTest>
- Larson, J. R. & C. Christensen. 1993. Groups as problem solving units: Toward a new meaning of social cognition. *British Journal of Social Psychology* 32. 5–30. doi:10.1111/j.2044-8309.1993.tb00983.x.
- Lenth, R. V. 2016. Least-squares means: The R package lsmeans. *Journal of Statistical Software* 69(1). 1–33. doi:10.18637/jss.v069.i01.
- Loukusa, S. & E. Leinonen. 2008. Development of comprehension of ironic utterances in 3- to 9-year old Finnish-speaking children. *Psychology of Language and Communication* 12(1). 55–69. doi:10.2478/v10057-008-0003-0.
- Matthews, J. K., J. T. Hancock & P. Dunham. 2006. The roles of politeness and humor in the asymmetry of affect in verbal irony. *Discourse Processes* 41(1). 3–24. doi:10.1207/s15326950dp4101_2.
- Mercier, H. & D. Sperber. 2011. Why do humans reason? Arguments for an argumentative theory. *Behavioral and Brain Sciences* 34. 57–111. doi:10.1017/S0140525E10000968.
- Milanowicz, A. 2013. Irony as a means of perception through communication channels. Emotions, attitude and IQ related to irony across gender. *Psychology of Language and Communication* 17(2). 115–132. doi:10.2478/plc-2013-0008.
- Nakagawa, S. & H. Schielzeth. 2013. A general and simple method for obtaining R^2 from generalized linear mixed-effects models. *Methods in Ecology and Evolution* 4. 133–142. doi:10.1111/j.2041-210x.2012.00261.x.
- Nicholson, A., J.M. Whalen & P.M. Pexman. 2013. Children’s processing of emotion in ironic language. *Frontiers in Psychology* 4. 691. doi:10.3389/fpsyg.2013.0069.
- Orsini, A., L. Pezzuti & L. Picone. 2012. *Wechsler Intelligence Scale for Children-IV (Italian edition)*. Firenze, IT: Giunti.
- Pennington, N. & R. Hastie. 1993. Reasoning in explanation-based decision making. *Cognition* 49. 123–163. doi:10.1016/0010-0277(93)90038-W.
- Pexman, P. M. & M. Glenwright. 2007. How do typically developing children grasp the meaning of verbal irony?. *Journal of Neurolinguistics* 20(2). 178–196. doi:10.1016/j.jneuroling.2006.06.001.
- Pexman, P. M., M. Glenwright, A. Krol & J. Tammy. 2005. An acquired taste: Children’s perceptions of humor and teasing in verbal irony. *Discourse Processes* 40(3). 259–288. doi:10.1207/s15326950dp4003_5.
- Pexman, P.M., L. Zdrzilova, D. McConnachie, K. Deater-Deckard & S.A. Petrill. 2009. “That was smooth, Mom”: Children’s production of verbal and gestural irony. *Metaphor and Symbol* 24. 237–248. doi:10.1080/10926480903310286.

- Pieterneel, D., D. Barelds, R. Sieuwke & A. Nauta. 2011. Humor Styles and their Relationship to Well-Being among the Gifted. *Gifted & Talented International* 26(1-2). 89–98. doi:10.1080/15332276.2011.11673592.
- Raven, J., J. C. Raven & J. H. Court. 2000. *Standard progressive matrices*. Oxford: Psychology Press.
- Recchia, H. E., N. Howe, S. H. Ross & S. Alexander. 2010. Children's understanding and production of verbal irony in family conversations. *British Journal of Developmental Psychology* 28. 255–274. doi:10.1348/026151008X401903.
- Reis, S. M. & J. S. Renzulli. 2009. Myth 1: The gifted and talented constitute one single homogeneous group and giftedness is a way of being that stays in the person over time and experiences. *The Gifted Child Quarterly* 53(4). 233–235. doi:10.1177/0016986209346824.
- Shade, R. 1991. Verbal humor in gifted students and students in the general population: Comparison of spontaneous mirth and comprehension. *Journal for the Education of the Gifted* 14(2). 134–150. doi:10.1177/016235329101400203.
- Sharifi, H. & M. Sharifi. 2014. Comparing emotional intelligence and humor in gifted and nongifted students. *Indian Journal of Scientific Research* 7(1). 1319–1324.
- Shi, J., T. Tao, W. Chen, L. Cheng, L. Wang & X. Zhang. 2013. Sustained attention in intellectually gifted children assessed using a continuous performance test. *PLoS ONE* 8(2). e57417. doi:10.1371/journal.pone.0057417.
- Subotnik, R. F., P. Olszewski-Kubilius & F. Worrell. 2011. Rethinking giftedness and gifted education. A proposed direction forward based on psychological science. *Psychological Science in the Public Interest* 12(1). 3–54. doi:10.1177/1529100611418056.
- Thompson, V. A., J. St. B. T. Evans & S. J. Handley. 2005. Persuading and dissuading by conditional argument. *Journal of Memory and Language* 53. 238–257. doi:10.1016/j.jml.2005.03.001.
- Tindale, R. S. & T. Kameda. 2000. 'Social sharedness' as a unifying theme for information processing in groups. *Group Processes & Intergroup Relations* 3. 123–140. doi:10.1177/1368430200003002002.
- Tindale, R. S., H. M. Meisenhelder, A. A. Dykema-Engblade & M. A. Hogg. 2001. Shared cognitions in small groups. In M. A. Hogg & R. S. Tindale (eds.), *Blackwell handbook in social psychology: Group processes*, 1–30. Oxford: Blackwell.
- Wilson, D. & D. Sperber. 1992. On verbal irony. *Lingua* 87. 53–76. doi:10.1016/0024-3841(92)90025-E.
- Wittenbaum, G. M. & G. Stasser. 1996. Management of information in small groups. In J. L. Nye & A. M. Brower (eds.), *What's social about social cognition*, 3–28. Thousand Oaks, CA: Sage.
- Ziv, A. & O. Gadish. 1990. Humor and giftedness. *Journal for the Education of the Gifted* 13(4). 332–345. doi:10.1177/016235329001300404.