

You surely know what I mean.

Theory of Mind and Non-Literal Language Comprehension

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1 Introduction

A full understanding of language requires not only the recognition of the literal meaning of sentences, but also of the communicative intention of the speaker. In some cases, the latter clashes with the former, as in metaphors and irony (e.g. uttering “Your room is a battlefield” or “Your room is extremely clean” to comment on a very messy room).

Several authors linked the comprehension of non-literal language to Theory of Mind (ToM) abilities. Sullivan et al. (2005) argue that only typically developing (TD) children who pass 2nd order ToM tasks can distinguish jokes (and irony) from lies; and Happé (1993) tested children with autism spectrum disorders (ASD) and TD 5 year-olds with different levels of ToM, and claimed that 1st order ToM is sufficient for metaphor understanding, whereas irony comprehension calls for 2nd order ToM. Nevertheless, the link between non-literal language comprehension and ToM abilities has been questioned. In the first place, even if TD 5 year-olds understand metaphors grounded on physical- or action-resemblance (Keil, 1986; Vosniadou et al., 1984; Winner et al., 1980), a full understanding of metaphors is achieved only after age 11 (Billow, 1975), and there is a clear developmental trend (Cometa & Eson, 1978; Gentner, 1988), whereas 1st order ToM is reached at 4 years of age. Moreover, Norbury (2005) tested children with communication impairments (ASD and/or language impaired) and found that semantic abilities were a better predictor of metaphor comprehension than ToM abilities; and Szücs (2013) found that, in TD pre-schoolers, language, but not ToM, abilities could predict metaphor understanding, whereas irony comprehension was influenced by chronological age. And, in general, it is well known that the performance on ToM tasks is highly dependent on language abilities (Happé, 1995 and Astington & Jenkins, 1999).

2 The study

To further investigate the cognitive abilities that are involved in non-literal understanding and disentangle the factors at play in different kinds of non-literal language, we compared the understanding of metaphors and irony in a typical and atypical population, i.e. children with conventional hearing aids, whose linguistic and ToM abilities are delayed with respect to their TD peers (Woolfe et al., 2002; Peterson & Siegal 1999; Peterson, 2004).

Participants

We tested 22 Italian deaf children (12 female and 10 male) aged 8 to 11 (8;1-11;8; MA 9;7) early diagnosed with a hearing loss (41 to 70 db), with conventional hearing aids, and an exclusively oral education (HA-group). Their scores on language tests (PPVT for the receptive lexicon, and the TCGB for grammatical comprehension) matched 6 year-old TD children. A group of 24 TD children attending 1st grade at

primary school (6 years of age) served as controls.

Materials and Procedure

Children were administered two ToM tasks: the Smarties Test, which tests 1st order ToM abilities, and Laura & Gino test, a test for 2nd order ToM abilities, adapted for children with hearing difficulties, that contains a question for 1st order ToM and a question for 2nd order ToM.

We also administered two novel tests for metaphor and for irony comprehension. The test for Metaphor was modelled after Norbury (2005) and required the completion of a total of 15 sentences: 5 Metaphors, 5 Similes and 5 Literal sentences. An example for the metaphor condition is given below. Please note that besides the target (“an earthquake”), there was always a competitor (“a waiter”), i.e., a term that could in principle be predicated of the subject, but that in the given context was irrelevant, and two distractors (“a bicycle” and “a Thursday”):

(MET) Carla leaves a mess wherever she goes. (She) is really ...

an earthquake	a waiter	a bicycle	a Thursday
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The test for Irony comprehension comprised a total of 8 short stories, followed by a remark, that was ironical in 4 stories, and literal in the other 4. Four stories presented a negative context, and the other 4 stories had a positive context. The interaction of the irony-literal and of the negative-positive context resulted in 4 conditions, schematized below:

	Ironic remark	Literal remark
Negative context	Irony_NegContext_PosRemark Tag: IrNP	Literal_NegContext_NegRemark Tag: LitN
Positive context	Irony_PosContext_NegRemark Tag: IrPN	Literal_PosContext_PosRemark Tag: LitP

Table 1: Conditions in the test for Irony comprehension

Examples of the two types of Ironic remarks are given below.

(IrNP) Chiara is helping her mother in making a cake. Mum asks her to stir the ingredients, but Chiara let the bowl fall, and the dough ends up on the table and on the floor.

Then mum says to Chiara: **You really did a great job!**

(IrPN) Daniela tells Lucia to put in the new bookshelves all the books, more than a thousand. At the end of the day, Daniela passes by, and she sees that Lucia finished with all the books.

Then Daniela says to Lucia: **You did nothing at all!**

Results

As for the ToM tasks, the HA-children’ scores were not significantly different from the TD children ($p=.963$, n.s). Since in both groups some children passed only the Smarties task, but not the 1st order question in Laura & Gino task (whereas all the children who passed 1st order question in Laura & Gino also passed the Smarties task, and all the children who reached 2nd order question in Laura & Gino correctly answered all the other questions), we decided to consider two groups of 1st order ToM. We plot children’s distribution in Fig. 1.

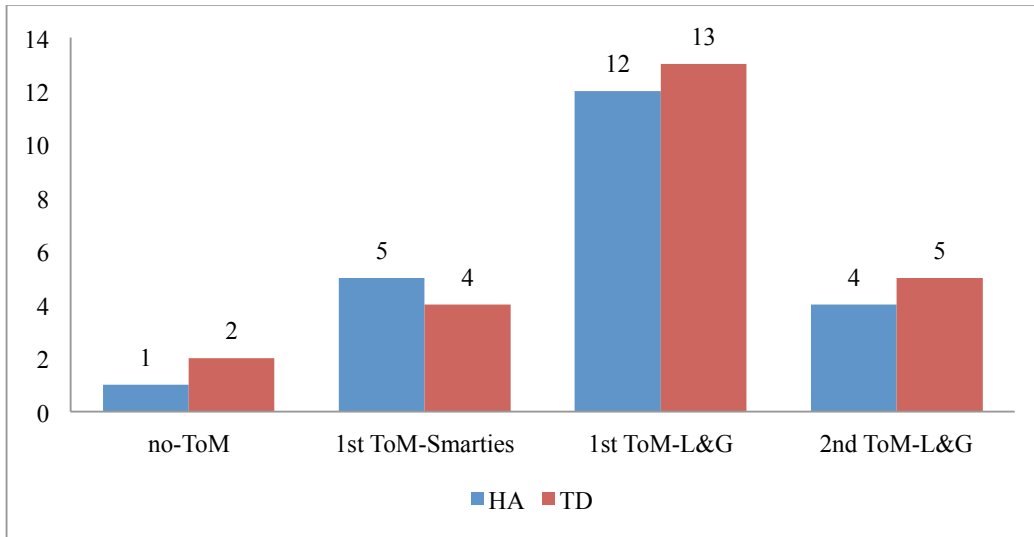


Figure 1. Distribution of children (HA-group=blue bars; TD-group=red bars) with respect to their performance in the ToM tasks: no-ToM= children who did not pass any ToM tasks; 1st ToM-Smarties= children who passed Smarties task; 1st ToM-L&G children who passed the 1st order question in Laura & Gino task; 2nd ToM-L&G= children who passed 2nd order question in Laura & Gino task.

As for the Metaphor task, the results for the Metaphor condition are plotted in Fig. 2.

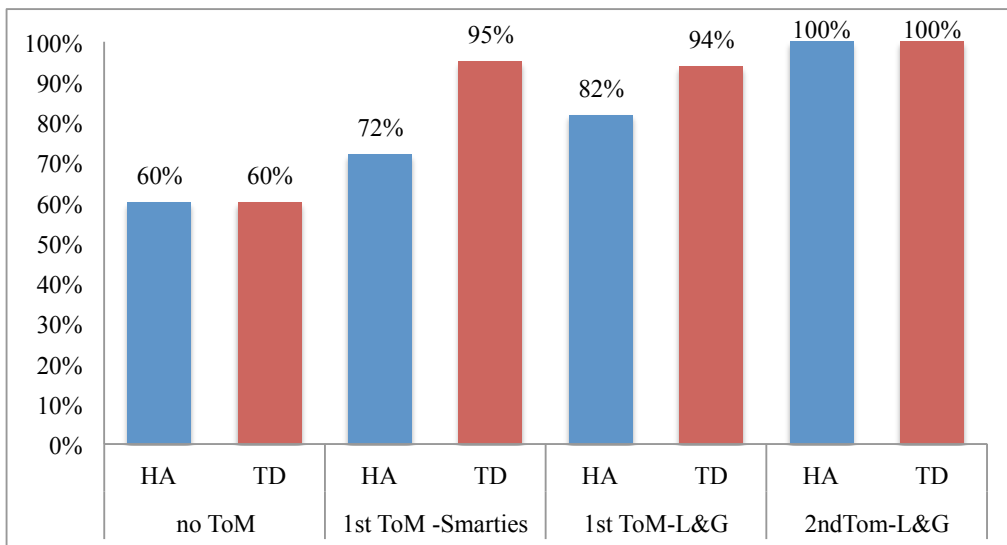


Fig. 2. Accuracy in the Metaphor condition, by group and level of ToM, as defined in Fig. 1.

A one-way anova revealed a difference between the HA- and the TD-group ($p=.013$). In the TD-group, only the two children who did not pass any level of Tom (the no ToM group) differ from the other groups. In the HA-group, since there was only one child who failed all ToM tasks, he was excluded from further analyses. The 2nd ToM group (100% accuracy) differs from 1st ToM-Smarties (72%, $p=.006$) and from 1st ToM-L&G (82%, $p=.042$).

As for the Irony task, the accuracy in the Literal condition was at ceiling for all groups. We considered the two Irony conditions (IrNP vs IrPN) and plotted them

separately in Fig. 3.

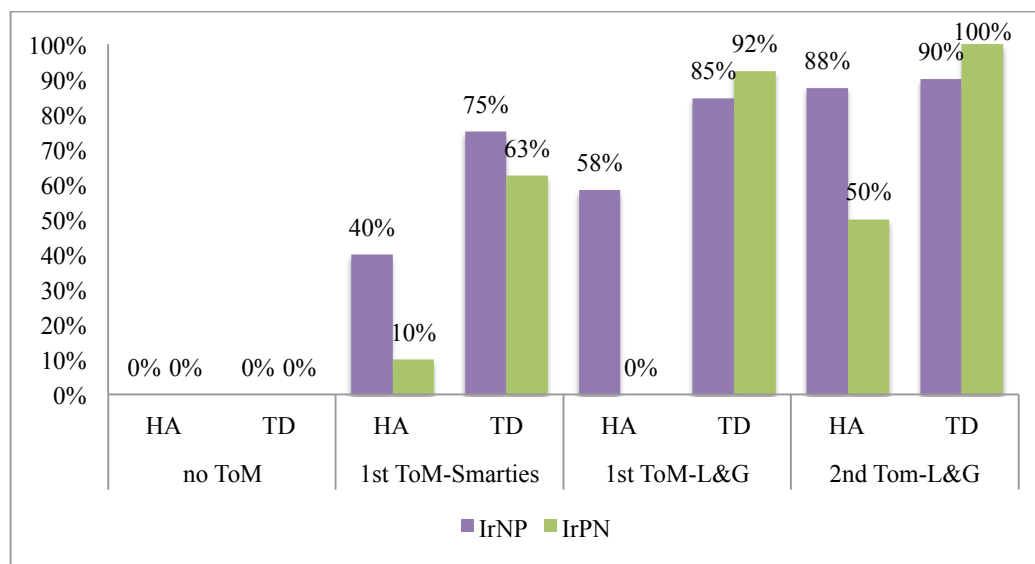


Fig. 3. Accuracy in the Irony task, for Irony in a negative context with a positive remark (IrNP, purple bars), and for Irony in a positive context with a negative remark (IrPN, green bars), by group and level of ToM.

In the TD group, the no-ToM children differ from the other groups in both conditions. In the IrNP condition, there is no difference in the other groups. In the IrPN condition, the 1st ToM-Smarties group differ from 1st ToM-L&G group (63% vs 92%, $p=.44$) and from 2nd ToM group (63% vs 100%, $p=.027$). In the HA-group, the child with no levels of ToM was excluded from analysis. In the IrNP condition, there is only a difference from 1st ToM-Smarties and 2nd ToM-L&G (40% vs 88%, $p=.051$). In the IrPN condition, the HA-group accuracy is extremely low (0% in the no-ToM and 1st ToM-L&G; 10% in the 1st ToM-Smarties, and 50% in the 2nd ToM-L&G), and 1st ToM-Smarties differs from the other groups ($p=0.22$ vs 1st ToM-L&G; $p=.001$ vs 2nd ToM-L&G).

Discussion

The results show that HA-children experience serious problems in the comprehension of non-literal language, and their difficulties seem to be more severe than their TD peers with analogous levels of ToM.

In the Metaphor task, as in Happé (1993), for TD children 1st order ToM abilities are sufficient for metaphor comprehension. But this is not the case for HA children: the accuracy on Metaphors is tightly linked to ToM abilities (1st order ToM differs from 2nd order ToM). At ceiling performance is only reached by the 2nd ToM group.

In the Irony task, despite their at ceiling performance on Literal controls, the No-ToM children (1 HA and 2 TD) fail to recognize all 4 ironical remarks (and interpret them literally). Ironical negative remarks in positive contexts (IrPN) are extremely hard for HA children (but not for TD). For ironical positive remarks in negative contexts (IrNP, the only ones tested by Happé), we did not find differences in the TD ToM groups (accuracy >75% from 1st ToM-Smarties). In the HA ToM groups there is a continuum in the accuracy scores : 40% (1st ToM-Smarties)-58% (1st ToM-L&G)-88% (2nd ToM-L&G).

These results suggest (contra Happé, 1993) that passing 1st order ToM is not sufficient for Metaphor understanding in the HA group; and passing 2nd order ToM is

not necessary for Irony understanding in the TD group, while in the HA group 2nd order ToM is not sufficient for a full understanding of Irony (69% overall accuracy in both conditions). Thus, we did not find a clear relation between ToM abilities and metaphor and irony understanding.

We are currently exploring the hypothesis that linguistic competence might constitute a better predictor for figurative language comprehension (as Norbury 2005 and Szücs 2013 claimed for metaphor understanding), testing a novel group of younger children, matched one-by-one to the HA group for linguistic age.

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