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Early birds: Metaphor understanding in 3-year-olds

Nausicaa Pouscoulous*
University College London
n.pouscoulous@ucl.ac.uk

Michael Tomasello
Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

Abstract

To assess children's cognitive capacities to understand (rather than explain or paraphrase) metaphors, we investigated how 3-year-olds (n=36; 3;0-3;3) fare with novel metaphors corresponding to their world knowledge and linguistic competences using a behavioural choice paradigm. In a game, participants had to give the experimenter one of two objects referred to by a metaphorical expression. Unlike what previous literature suggests, our results indicate that 3-year-olds are able to understand novel metaphors that are appropriate for their vocabulary and world knowledge, based on action measures rather than metalinguistic responses. We discuss how factors other than incompetence with pragmatic inferencing can explain difficulties with metaphor comprehension.

Keywords: Pragmatic development, Metaphor, Language Development

Introduction

A child might be cold or warm toward strangers, an angel with her grandmother or a pig when eating. Children, like adults, live in a continuous stream of metaphors. This figure of speech – whereby an expression is used for a person, object or action that it does not literally apply to – is pervasive in everyday communication (Glucksberg, 1989) and has even been argued to be a core feature of our conceptual representations (Lakoff & Johnson, 1980; Lakoff, 1987, 1993). Children will come to understand and produce conventional metaphors, such as being emotionally 'cold' or 'warm', but also entirely novel ones – e.g., 'The tower with the hat' about a tower with a striking pointy roof. In both cases, the topic of the metaphor (e.g., the tower) borrows properties from the vehicle (hat), which belongs to a different category of objects – a process described by theorists from various backgrounds as a mapping across separate cognitive domains (e.g. Lakoff, 1993; Fauconnier & Turner, 1998; Kövescses, 2002). From around their first birthday, children exhibit impressive pragmatic abilities, which pave their way to language acquisition (Bloom, 2000; Clark, 2016; Matthews, 2014; Tomasello, 2003, 2008). Yet, classical studies suggest that metaphor comprehension is a late developing linguistic skill (Gibbs 1994; Nippold 1988/1998; Winner 1988/1997) – indeed this still seems to be a dominant view (Cacciari & Padovani, 2012).

Classical studies investigating the development of metaphor asked children to come up with their own interpretation of metaphors or explain their meaning (see, Winner, 1988/1997, for an overview). Overall, 3- to 5-year-olds understand the – literal – physical meaning of target expressions (picking up the appropriate object), but not their psychological sense (e.g., for 'cold', 'sweet' or 'soft'; Asch & Nerlove, 1960). Around the ages of five or six, children comprehend metaphors literally: they might retain the literal meaning of the target expression as a whole (Asch & Nerlove, 1960) or focus on part of the physical properties of the vehicle (some examples in Winner, Rosenstiel & Gardner,

1976). Alternatively, they might revert to understanding the utterance as part of a fictional story (some examples in Johnson, 1982). Although 7- to 10-year-olds attributed a psychological meaning to the terms used in these studies, they do not necessarily grasp the *intended* property – and produce what are considered inappropriate metaphorical interpretations (Winner et al., 1976). Finally, 11- and 12-year-olds seem to comprehend the metaphorical expressions and can articulate the link between the topic and the vehicle (e.g., Asch & Nerlove, 1960). Winner (1988/1997: 41–44) argues based on these findings that genuine metaphorical interpretations do not emerge until 10 years of age. Children first interpret the metaphorical expressions literally, or in a 'primitive-metaphoric' way (frequent in 8-year-olds). Then, they come up with 'inappropriate-metaphoric' interpretations. Finally, 'genuine' metaphorical interpretations appear around 10 years of age. In turn, these are properly explained by children older than 10. Metaphor, thus, appears to be fully understood only late in childhood. Some more recent findings seem to corroborate this developmental pattern (e.g., Dryll, 2009). This timescale of development may be taken to suggest that younger communicators' pragmatic competence and metaphor understanding develops with age, becoming close to adult-like only after the age of 10.

However, rather than reflecting children's poor ability to derive pragmatic inferences, their observed difficulty in understanding metaphors might be due in part to impeding empirical factors. First, different types of figurative language are often conflated in experimental materials (Cacciari & Padovani, 2012). Conventional metaphors, or even idioms, do not stem from the same interpretation process as novel metaphors. The former require learning culturally established – conventional – links (e.g., the sexy or cunning 'fox'), while the latter are built on-line using the literal lexical meaning, world knowledge and relevant contextual information. Novel metaphors do not require prior exposure to the metaphorical expression and seem, therefore, more

appropriate to establish children's abilities to derive the pragmatic inferences involved in metaphor comprehension (Pouscoulous, 2011). Second, conceptual knowledge linked to both the topic and the vehicle of a metaphor is crucial to grasp the non-literal sense of a metaphorical expression (Gentner, 1977). Indeed, metaphor comprehension emerges contemporaneously within the same conceptual domain (Keil, 1986; Özçaliskan, 2005). Thus, the absence of sufficient or appropriate vocabulary or world knowledge might block children's access to elements of metaphorical meaning. Finally, as for other pragmatic inferences, task complexity is paramount when gauging the development of metaphor (Vosniadou, Ortony, Reynolds, and Wilson, 1984). Metalinguistic tasks in particular require young communicators to reflect on the exact phrasing of the linguistic input). We consider 'metalinguistic' any task that involves a conscious reflection on the linguistic form of the utterance. Paraphrasing and explaining, used in many studies on metaphor development, are obvious examples (some truth value judgment tasks are, too). This type of task places demands on children, which may interfere with the accurate assessment of their linguistic proficiency in general (Gordon, 1998) and their pragmatic abilities in particular (Cacciari & Padovani, 2012; Katsos & Bishop, 2011; Pouscoulous Politzer, Bastide & Noveck, 2007; Schulze, Grassmann & Tomasello, 2013). In fact, young children do poorly on metalinguistic tasks and seem unable to paraphrase metaphorical expressions correctly until maybe as late as early adolescence (e.g., Asch & Nerlove, 1960; Cometa & Eson, 1978; Smith, 1976). Asking children to explain metaphors verbally may lead us to underestimate their comprehension (Gibbs, 1994; Winner 1988/1997). It turns out that children fare much better with tasks that do not tap into their capacity to make metalinguistic judgments and appear, then, to understand metaphors as early as 4 or 5 years of age (Özçaliskan, 2005, 2007; Pearson, 1990; Stites & Özçaliskan, 2013; Waggoner and Palermo, 1989).

An early ability to understand metaphor would be in line with recent findings

showing that 3- to 4-year-olds are proficient with other pragmatic inferences whose acquisition was also believed to be delayed, such as scalar implicatures (Katsos & Bishop, 2011; Pouscoulous et al. 2007), relevance implicatures (Schulze et al., 2013) or presupposition (Berger & Höhle, 2012). It seems that preschoolers can carry out complex linguistic pragmatic inferences when the experimental task is simple enough and when these inferences are relevant to them in context. Yet, the specificity of metaphor, which almost always involves category violation, might imply that its processing and development require elements over and above an inferential procedure akin to other pragmatic phenomena. Which other components, then, must coincide to enable young communicators to understand metaphor? Some are fundamental to all pragmatic inferences, such as semantic and syntactic knowledge, relevant context and manageable processing cost (which is particularly important for children, Noveck, Bianco, & Castri, 2001). Other abilities are specific to metaphor; for instance, adequate knowledge of the topic and vehicle domains. Analogy perception, which emerges very early (Goswami, 1991, 2001), plays an essential part, even though the exact nature of analogical reasoning involved in metaphor processing is subject to debate (Glucksberg, 2001 vs. Bowdle & Gentner, 2005 and Wolff & Gentner, 2011). Two complementary skills must be added to this list: the ability to refer to one and the same object with two different labels ('alternative naming' or 'second labels': Rubio-Fernández & Grassmann, 2016) and the ability to assign different senses to one and the same expression (polysemy).[1] While pre-schoolers understand ambiguous words (Srinivasan & Snedeker, 2011), as well as meaning shifts (Falkum, Recasens & Clark, 2016; Rabagliati, Marcus, & Pylkkänen, 2010), 3 to 5-year-olds struggle with alternative naming (Perner, Rendl and

[1] Here by 'polysemy' we mean the general ability to assign more than one meaning to a single word, rather than conventional cases of polysemy (e.g., 'journal' referring to the physical copy of a paper, the content of the paper, the institution publishing the paper, etc.), In the case of conventional metaphor both – literal and figurative – meanings are conventional, for novel metaphors the literal meaning is conventional while the metaphorical meaning is not.

Garnham, 2007; Perner, Stummer, Sprung and Doherty, 2002; Perner, Brandl and Garnham, 2003; see also Matthews, Lieven & Tomasello, 2010).

Bearing in mind the essential skills involved in metaphor comprehension and young children's known limitations, we wanted to assess how early they possess the cognitive ability to understand novel metaphors and whether the capacity to draw the pragmatic inference resulting in a metaphorical interpretation is present as soon as the necessary vocabulary and world knowledge are acquired. We investigated how 3-year-olds fare with novel metaphors corresponding to their world knowledge and linguistic competences using a behavioural choice paradigm, with a target toy referred to by a metaphor and a distractor toy. Methods such as explaining, paraphrasing or truth value judgement tasks (Crain & McKee, 1985; Crain & Thornton, 2000) were discarded to avoid involving metalinguistic skills. We focused on young 3-year-olds because this is the youngest age at which we found that children consistently master the literal meaning of a basic stock of vocabulary, something which is essential for novel metaphor interpretation. We also tested children's knowledge of the vocabulary used in the reference assignment task. If children grasp the relevant literal meanings, then their performance on the metaphor task can be taken as a genuine indicator of their comprehension of novel metaphor. Specifically, their ignorance of the literal meaning would not prevent them from deriving the metaphorical interpretation, and they would not mistakenly overextend the conventional literal meaning to encompass the figurative one (as has been argued for early metaphor production; for discussion see, Pouscoulous, 2011). Our hypothesis is that 3-year-olds can draw pragmatic inferences, including those involved in interpreting novel metaphors. A design stripped from complicating factors could bring to light children's cognitive capacities to understand metaphor, if indeed such abilities are present at such an early age.

Methods

Participants

Thirty-six monolingual German-speaking 3-year-olds were included in the study. Twenty-four of them were tested in the experimental condition. As a control, the other 12 were given a preference test with the study material to ensure that responses were indeed due to the linguistic cues rather than toy preference. Children were randomly assigned to the metaphor or the control group. In both groups there was an equal number of boys and girls whose ages ranged between 3;0 and 3;3. During piloting (with 18 children 2;6 to 3;6) we found this to be the youngest age at which children did not display large disparities in the expressions they understood or used literally. An additional five children were tested but excluded from the final sample because they did not meet the baseline criteria (i.e., they failed two or more of the familiarisation trials). Children were recruited from a database of parents who volunteered to participate in research on cognitive development. They came from diverse socio-economic backgrounds and were tested in nurseries in a middle-sized German city.

Materials and Design

Children played a game in which they had to hand the experimenter one of two objects referred to by a metaphorical expression. In each case, the metaphorical expression was the only cue given to the child to assign the correct referent.[2]

Seven novel metaphors of the form [the X with the Y], where the qualifier (Y) was figurative, were created using objects familiar to 3-year-olds. The target domains for all

[2] Since the metaphorical expressions were embedded within a reference assignment task, it could be argued that picking up the correct object requires two pragmatic inferences, rather than simply one: metaphor interpretation and reference assignment.

metaphors were body parts or clothing, which children know well. We only used visual and behavioural metaphors, since metaphors based on observable physical similarities are easier to interpret for young children than metaphors relying on abstract relations (Gentner, 1988). While children can perceive the same physical similarities as adults, they may lack sufficient or relevant world knowledge to perceive abstract – functional or psychological – similarities between the topic and the vehicle (Winner, 1988/1977). In each trial, children were presented with a pair of almost identical toys. The target toy displayed the attribute picked up by the metaphor (e.g., a pointy roof for "the tower with the hat"), while the other toy had another salient, but irrelevant attribute (a tower with a balcony and a flat roof). There was no object displaying the literal property of the test expression, since this would have resulted in cases of ambiguity – with both literal and metaphorical meanings being correctly depicted – and presumably confused the children. A list of all test materials in given in Table 1.

Table 1: Metaphors with corresponding target and distractor items.

Metaphor	Target toy	Distractor toy
The dog with the *brown shoes*	Dog with brown feet	Dog with a brown bow
The tower with the *hat*	Tower with a pointy roof	Tower with a balcony
The car with the *backpack*	Car with a parcel on its roof	Car with a parcel inside
The bug with the *jacket*	Ladybug with spotted wings	Same beetle a leaf in its mouth (no wings)
The carrot with the *hair*	Carrot with long fuzzy greens	Carrot circled by dark lines (very short greens)
The bottle with the *big belly*	Round yellow bottle	White slender bottle
The car with the *sick foot*	Car with a missing wheel	Car with a missing door

Ten adult native speakers of German were tested to validate the method and ensure that the novel metaphors were readily understandable. They always chose the toy referred to by the metaphor for all stimuli.

Four literal items were used to familiarise children with the object selection procedure (e.g., “the doll with the dress” for two similar dolls, one wearing a dress and the other trousers).

Children in the test group were given a naming-and-pointing game with a picture book to determine their comprehension and production of the vocabulary used in the act-out task. The book was divided in two parts: one for comprehension and one for production, both with one page for each of the seven metaphors. Each page displayed both an object representing what the metaphorical expression means literally (e.g., hat) and what it referred to metaphorically (a roof). This was done to establish whether children overextended the literal meaning of a term (e.g., pointing to the roof picture when asked to show the ‘hat’). In addition, each page had a picture of the salient attribute of the distractor toy (e.g., ‘balcony’), as well as a distractor and the picture of a nameless object. The latter was included to prevent children from choosing the correct picture using deduction by elimination. At the end of both the comprehension and production tasks, we presented the children with a picture of a child (a boy or a girl) to examine children’s knowledge of body parts.

Procedure

Children were tested in a separate room at their kindergarten. Children sat at a table across from the first experimenter. Another experimenter sat next to them to make them feel comfortable and prevent them from grabbing the toys at inopportune moments. When the children were ready, they were presented the four familiarisation trials followed by the seven experimental trials. The pointing-and-naming picture book

assessment was carried out last in order to avoid any effect of the vocabulary test on children's performance on the metaphor task. All sessions were videotaped.

During the familiarisation trials, which were always presented in the same order, children were corrected when they made a mistake. If children handed the wrong toy more than once during these familiarisation trials, they were excluded from the analysis.

In the test phase the first experimenter showed two objects to the children, asked them to name them and played with them. The key features of test or distractor items were never mentioned at this stage (e.g., the roof or balcony for the tower). The child was given the toys to play with for less than a minute. Then, the first experimenter placed the two objects in front of the children and asked them to hand one of them referred to with a metaphorical description (e.g., "Give me the tower with the hat"). When the children had made their choice and handed one of the objects back, the experimenter asked for "the other one". The position of the target toy (right or left) was counterbalanced. The order of the metaphor tasks was randomised, namely, the pairs of toys appeared in random order for each participant. Each pair of toys appeared first roughly the same number of times across participants.

The procedure for the control preference test was the same as for the metaphor comprehension test with one difference. At the end of each trial, the main experimenter asked for one of the objects saying: "Give me one of them"; there was no descriptor. After the children had made their choice and handed one of them, they were asked, "And the other one."

Finally, children were shown a picture book to play a naming-and-pointing vocabulary game. In the comprehension section they were asked to point to pictures of type of objects relevant to metaphorical items in the metaphor test (e.g., "Show me the hat", "Show me the roof", "Show me the balcony"). Occasionally, the experimenter also asked children to point to objects irrelevant to the metaphor test. In the second set of

pages, dedicated to production, children were asked to name various objects on the pages (e.g., “What is this?” pointing at a hat, a roof or a balcony).

Coding and reliability

In the metaphor task an object was considered chosen if it was the first one that the child handed to the experimenter. For the metaphor group the toy corresponding the metaphorical interpretation of the test utterance was deemed correct. For the control group, there was no right answer for the child’s toy preference.

In the pointing vocabulary comprehension task, the answers were counted as correct when the child indicated the picture corresponding to the expression used and as incorrect in all other cases. A special note was made when the child pointed to the object corresponding to the metaphorical, rather than the literal, interpretation of the expression used metaphorically in the act-out task (e.g., if the child pointed to the roof when asked to show the ‘hat’), thereby indicating that they might be overextending the meaning of the term. In the picture book production task, answers were considered correct if the child named the object accurately; this included the use of rarer synonyms, dialectal expressions or words with slightly broader or narrower denotations than the expected one (e.g., ‘fingers’ or ‘arm’ instead of ‘hand’).

All trials were coded independently by two coders and agreement was 100%.

Results

Parametric tests – t-tests and Pearson’s correlation bootstrapped for 95% CI – were used for the analyses. All tests were two-tailed, and significance was set at 0.05. Three-year-olds understood novel metaphors in the reference assignment task. Children in the metaphor group chose the correct toy significantly above chance (73%; $t(23) = 6.486$, $P < 0.001$), while the control group had no preference for the target object in the absence

of linguistic cues (46%; t(10) = 1.20, P = 0.257). Target objects were chosen significantly more often by the metaphor group than by the control group (t(34) = 4.720, P < 0.001).[3] Table 2 illustrates responses for the act-out task. A visual examination suggests that not all metaphors were equally well understood. Specifically, two of the items were bellow 60% correct: 'the carrot with the hair' and 'the car with the sick foot'. This may be due either to some novel metaphor being less clear than others or to ineffective experimental material (i.e., not making the target property salient enough). In the case of the 'car with a sick foot', we suspect the toy car might have been too small for some children to notice the missing wheel. As for the 'bug with a jacket', some children might already have been used to ladybirds with spotted elytra and therefore confused at the idea of calling a body part a 'jacket'.

Table 2: Percentage of target object answers for metaphor and control groups

Metaphor	Test group	Control group
The dog with the *brown shoes*	83	58
The tower with the *hat*	87	33
The car with the *backpack*	75	25
The bug with the *jacket*	58	50
The carrot with the *hair*	62	41
The bottle with the *big belly*	87	41
The car with the *sick foot*	58	75

Children showed a good knowledge of the vocabulary tested in the naming-and-pointing game (91% correct answers overall: 95% for comprehension and 87.5% for

[3] As suggested by a reviewer, we also ran a Logistic Mixed Effects Regression Model. The model was fitted in R (version 3.4.4; R Core Team. 2018) using the function glmer of the package lme4 (version 1.1-17; Bates et al. 2015) with condition as a fixed effect (1=experimental, 0=control) and random intercepts for participants and items (metaphors). We found a significant effect of condition (estimate = 1.14, SE = 0.28, $\chi^2(1) = 16.18$, $p < 0.001$), which corroborates the findings of the parametric tests. Note, nonetheless that variance for random intercepts for participants and items was 0 or nearly 0, suggesting that a mixed model does not improve the analysis of these data.

production). No child was excluded from the analysis on the metaphor task because of poor mastery of the literal meaning of the expressions tested in the vocabulary test (no less than 76% correct). There was no correlation between correct choices on the metaphor task and vocabulary comprehension ($r = 0.231$, $P = 0.277$), nor with vocabulary production ($r = 0.221$, $P = 0.299$), or overall ($r = 0.262$, $P = 0.216$).

If a child's literal semantic representation of a test expression includes its figurative meaning, this particular item would not reveal anything about the child's ability to comprehend metaphor. Thus, correcting for potential errors, cases in which children had made a mistake in the comprehension task (such as using overextensions) were recoded as incorrect in the metaphor task. There was no effect on the results: they still chose the correct object above chance in the metaphor task ($t(23) = 4.736$, $P < 0.001$) and more often than the control group ($t(34) = 3.620$, $P = 0.001$). Interestingly, five out of the eight overextensions cases were for the carrot's 'hair' and three for the car's 'backpack'; neither of these objects have readily available names in a child's vocabulary (i.e., carrot greens and car roof box).

Discussion

This experiment investigated young children's ability to make the pragmatic inferences leading to a metaphorical interpretation. Our results indicate that in a behavioural choice task 3-year-olds understand metaphors that are novel and age-appropriate. The ability to understand non-literal language seems to be in place at the earliest testable ages. Indeed, our pilot study, which included younger children, suggested that 3 years is the youngest age where we can expect children to consistently master the literal meaning with enough vocabulary to probe their figurative understanding.

For an expression to be metaphorical, its non-literal use has to be intentional, and for it to be understood as a metaphor, the hearer has to perceive it as such

(Marschark & Nall, 1985). Three alternative interpretations of the data could be imagined: one in terms of overextension, another in terms of association, and finally one in terms of pretence. In our study, nothing in the children's reaction suggests they viewed the metaphors as a mistake on the speaker's part. Their performance on the naming-and-pointing vocabulary picture book showed they had a good understanding of the literal meaning of the expressions used in the metaphor task. This indicates that children did not overextend the literal meaning of the metaphors, but genuinely gave them a non-literal interpretation (something the follow-up analysis confirms).

Another possible concern is that rather than being genuinely metaphoric, children's interpretations could be the outcome of a low-level mechanism such as association. It is, nonetheless, important to note that such an explanation could not rely on simple associative learning in the Pavlovian or Skinnerian sense (e.g., Heyes, 2012). An associative process that would guide the child to the correct response still requires identifying the properties relevant to the metaphorical interpretation (the tall pointed shape for the 'tower with the hat'), while ignoring those which are not (its architectural nature rather than clothing). This is no trivial associative task. Interestingly, metaphor interpretation in adults has on occasion been accounted for as a – fairly elaborate – associative process, rather than a fully inferential one (Recanati, 2004). The associative process put forward in this thesis remains pragmatic in nature. Thus, while our findings cannot rule out that children's interpretations are associative in this latter sense, their responses do not result from any simple association or overextension.

Finally, early metaphors can be viewed as cases of pretence rather than figurative expressions (Pouscoulous, 2011; Rubio-Fernández & Grassmann, 2016). Indeed, a widely recognised theory of metaphor analyses the trope itself as a form of pretence play (Walton, 1993). It is notoriously difficult to distinguish perceptual cases of metaphor from cases of linguistic pretence, since both can refer to non-literal attributes.

They can only be distinguished with certainty if a child starts making pretend actions with an object or tells an extended pretence story. Yet, it would be erroneous to assume that children only start understanding metaphor when they comprehend abstract metaphors. Indeed, the shift from understanding perceptual metaphors to understanding abstract metaphors seems linked to world-knowledge rather than the development of any cognitive ability (Keil, 1986). While it is theoretically possible that children interpreted the metaphorical utterances as pretend play in this study, it is nonetheless highly unlikely they did so. Indeed, during each trial, the children played with the toys for a few seconds before they heard the test utterance; none of them engaged in pretend play related to the metaphorical expressions during this time and they never acted in a manner consistent with a pretence interpretation upon hearing the test utterance either (e.g., removing or making the pointy roof move up and down after hearing the 'tower with the hat', or even referring to other parts of the tower as pieces of clothing or body parts).

The early metaphor comprehension we find contrasts with an important body of work which argues that metaphorical skills develop later in childhood (Cacciari & Padovani, 2012; Gibbs, 1994; Nippold, 1988/1998; Winner, 1988/1997). Yet, they agree with recent studies which suggest an earlier ability to comprehend meaning shifts (Falkum et al., 2016; Rabagliati et al., 2010) including metaphors (Özçaliskan 2005, 2007; Pearson 1990; Stites & Özçaliskan, 2013; Waggoner & Palermo 1989). The apparent difference in findings with the former body of work may be due to some of the factors we strived to control for: the use of age-appropriate vocabulary, materials and task of limited complexity, as well as a focus on novel (rather than conventional) metaphors. Importantly, we used a task which does not appeal to metalinguistic skills (unlike the more traditional paraphrasing or metaphor explanations). This is likely to have been the divergence with the most consequential effect. Indeed, Bernicot and colleagues (2007), for instance, find that children can fail on a metapragmatic task

several years after they are shown to understand a pragmatic phenomenon on a simple picture selection task. Cacciari & Padovani (2012) make a comparable argument against the use of (meta)linguistic tasks to investigate the acquisition of idioms. Similarly, children appear able to understand various types of implicatures earlier than previously established when tested on act-out tasks rather than truth value judgment tasks (which we also consider to be metalinguistic in nature, Grosse, Schulze, Noveck, Tomasello, Katsos, 2011; Kastos & Bishop, 2011; Pouscoulous et al. 2007; Schulze et al. 2013; Stiller, Goodman & Frank, 2015). Our design endeavoured to minimise the experimental factors which can impede children's comprehension of metaphor, which would have left us with a – possibly – mistaken view of their abilities. The most plausible explanation for our findings is that we provided children with a task that was age-appropriate, allowing 3-year-olds to demonstrate their ability to make the pragmatic inference involved in understanding a novel metaphor.

Interestingly, such an early metaphor understanding may seem at odds with current understanding of the development of cognitive skills key to metaphor interpretation. Since pragmatic inferences rest on the recognition of the speaker's informative and communicative intentions (Grice, 1957/1989), it has long been argued that understanding metaphor (and other pragmatic phenomena) requires theory of mind. Our findings contrast with the more specific view that children should be able to pass a standard false belief task to understand metaphor (Happé, 1993). While participants were not tested on any false belief task, their age (3;0 – 3;3) suggests they would not perform well on one of the standard versions, which children typically fail before the age of four (Baron-Cohen, Leslie & Frith, 1985; Wimmer & Perner, 1983; Wellman, Cross & Watson, 2001). Some other studies on implicature understanding also report that children perform well before the false belief task watershed (Schulze et al., 2013; Grosse et al., 2011; Stiller et al., 2015). Our study adds to a growing body of research indicating

that being able to pass a standard false belief task in not a prerequisite for metaphor comprehension (Norbury, 2005; Zufferey, 2015). Furthermore, as noted above, in addition to the skills they need for other pragmatic inferences, children must master some abilities specifically to understand metaphors: analogical perception, coping with alternative naming or polysemy. While we know 3-year-olds can achieve the first two (see respectively, Goswami, 1991, 2001 and Rabagliati et al., 2010), they appear to experience problems attributing two labels to one and the same object before the age of 4 (Perner et al., 2007; Perner, et al., 2002; Perner et al., 2003). But, the clash between our findings and this well-established phenomenon is only a surface one. Indeed, children only experience difficulties with second labels when an entity is given two different names in the same context, creating two confronting perspectives within the same scenario (Perner et al., 2007; Perner, et al., 2002; Perner et al., 2003). Precisely to avoid any confronting perspectives, great care was taken in the study never to mention the literal label for the object referred to metaphorically. It is therefore not entirely surprising the children manage our task at an age when they would most probably fail an alternative naming task.

Importantly, our findings do not imply that metaphor comprehension stays stationary through childhood. With time, these 3-year-olds will come to understand brains as computers, see relationships as hell or paradise and enjoy Shakespeare's sonnets. Our focus in this study was the emergence of the inferential ability to grasp metaphorical meaning, which seems present as early as we can test for it. Three-year-olds are already proficient in deriving the intended metaphorical interpretation based on the literal sense and the context. Yet, there is no doubt that their expertise with figurative language will continue to grow as their vocabulary, world-knowledge and processing resources develop (Gibbs, 1994; Pouscoulous, 2014; Vosniadou, 1987; Winner,

1988/1997). For instance, children who understand metaphorical expression on a picture selection task may still perform better when given a literal description (Declercq, Baltazart & Didon, 2010; Di Paola, Domaneschi, Pouscoulous, submitted). Future research should look carefully at the role of several important factors – both linguistic and cognitive (linguistic factors might include linguistic intelligence; Deckert, Schmoeger, Schaunig-Busch & Willinger, 2019 or semantic knowledge, shown to be paramount for children with autism; Gernsbacher & Pripas-Kapit, 2012; Norbury, 2005, and one cognitive factor might be inhibitory control, shown to be linked to metaphor interpretation in some neuroatypical populations; Amanzio, Geminiani, Leotta & Cappa, 2007; Gold, Faust & Goldstein, 2010; Monetta & Pell, 2007). Finally, as mentioned above, some aspects of metaphor set it apart from other pragmatic inferences in general, but also from other meaning shift; it would be worth investigating how these differences in nature translate in the way children acquire phenomena, such as metaphor, metonymy and hyperbole.

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