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METAPHORS IN PRESCHOOL CHILD THINKING ABOUT THE MIND

The study is an attempt to answer the question how the preschool child understands metaphors. We assumed that the ability to perceive and understand metaphorical similarity between objects or events consisted of the child's knowledge about the mind, especially the knowledge that an object or event can be represented mentally in many ways.

The subjects of the study were 120 children aged between 3.3 and 5.9 (40 children in each six-month interval: 3.3 to 3.9; 4.3 to 4.9; 5.3 to 5.9). The children were tested with three different false belief tests and a metaphor test. To examine child's theories of mind we used modified version of unexpected transfer test, deceptive box test and a picture version of false belief task which was constructed by us (see: Białecka-Pikul, 2002). The metaphor test consisted of 10 pairs of pictures. To avoid asking questions directly related to the metaphor we used a doll which "spoke" for us. The doll looked at the pair of pictures. In each pair, one picture presents the vehicle of a metaphor (e.g. a frog) and the other illustrated the topic (e.g. a girl dressed in green). The doll looked at the picture of the topic (in this example – a girl dressed in green) and asked 'a strange, silly question' – here, 'do you live in a lake?'. The child had to discover the doll's belief. The test question was always the same: Why would the doll ask such a question, why did she ask this? To give the correct answer the child has to notice and understand the metaphor (in this example, as green as a frog).

It was established that we could treat the understanding of metaphors as an expression of a child's theory of mind (on average, $r = 0.58$ on $p = 0.01$). Moreover, it is easier for a child to understand metaphors related to conventional expressions and understanding metaphors is connected with the modality which was the basis of similarity between the pictures (the most difficult were metaphors associated with size). The older children were better at understanding metaphors and they gave more sophisticated, creative and less elliptical answers.

Introduction

Since 1983 when the article "Beliefs about beliefs" by Wimmer and Perner was published, we have observed an increasing interest in the area of research called "children's theories of mind". Scientists used this term more or less strictly as Flavell, Miller and Miller (1993) noted. They wanted to describe "an abstract, coherent, causal-explanatory system that allows the child to explain and predict behavior by referring to unobservable mental states such as beliefs and desires" or "any knowledge about the mind - any naive psychology - the beginnings of which can be seen in infants" (p.100). The so-called false belief task, in a version of unexpected transfer test (or Maxi task or Sally-Ann task) stands

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for a critical, hallmark or litmus test of theory of mind. This classic task presents a child with the following scenario (Wimmer and Perner, 1983): Maxi puts the chocolate in the kitchen cupboard and leaves the room to play. While he is away and cannot see, his mother, preparing a chocolate cake, puts the chocolate from the cupboard into the drawer. Where will he look for the chocolate when he comes back, in the drawer or in the cupboard? Four- and five-year-olds usually answers taking into account Maxi's false belief that for him the chocolate was in the cupboard. Three-year-olds do not understand the situation and give a wrong answer assuming that Maxi will look for the chocolate where it really is. After twenty years of research Wellman, Croos and Watson (2001) analyzed over 170 studies where different versions of the false belief test were used and proved that false-belief performance showed a consistent developmental pattern even across various countries and various task manipulations. The data obtained serve as an evidence of a genuine conceptual change in the preschool years, but leave many questions unanswered. Perhaps the most interesting is the question of whether the false belief test is the only valid method to examine children's knowledge about the mind. Can we measure children's understanding of the content of mental representation by other techniques? This question was the first inspiration for the present research.

Problem

The title of the paper indicates that the material used to construct a method were metaphors. In examining a child's ability to understand the beliefs of others, a task of perceiving and understanding metaphors could be used. The first point of the present paper is to justify this statement theoretically. In other words, reasons why understanding metaphors can be a measure of children's theories of mind will be presented. Then the empirical attempt to research the problem will be described. The constructed metaphor test as well as standard false belief tests were administered to the same children. Analyzing the results in various ways made it possible to picture children's understanding of the mind in a way that could be obtained with the constructed method. Two-way differentiating metaphors made it possible to answer two questions. First, does the basis of similarity, the feature that should be perceived, for example color, to realize the metaphor influence children's understanding of metaphors? Secondly, is children's ability to represent beliefs of others in metaphors connected with linguistic knowledge?

The last point of the paper is to answer the main developmental question, how children's knowledge about the mind changes over the preschool years.

On constructing the method

When we started constructing this method¹, my idea was supported by John Flavell's and others' (1993) claim that around the age of four a child's knowledge about the

¹ I am very grateful to Prof. Maria Kielar-Turska whose idea to use metaphors in my research on theories of mind turned out to be very creative. She was also the supervisor of this work. I am also grateful to Agnieszka Żarska who conducted the pilot study.

Table 1. The tested group

Age	Level of parent's education				Total
	Higher		Secondary or lower		
	Boys	Girls	Boys	Girls	
3;3-3;9	10	10	10	10	40
4;3-4;9	10	10	10	10	40
5;3-5;9	10	10	10	10	40
Total	30	30	30	30	120

mind may be expressed in a variety of skills: perspective-taking, distinguishing between appearance and reality, understanding lies, jokes and metaphors. When children understand that the mind does not reflect reality and that people can hold beliefs that drive their behavior and change over time, they also can understand the nature of representation. Flavell called this understanding a major shift in knowledge about the mind. Before the age of four children also hold beliefs but they do not understand that other people's beliefs about the same thing could be different and could also cause different actions.

The other argument to support the idea that metaphors can be used to measure a child's understanding of mind was a major thesis in cognitive linguistics. Precisely it was Lakoff and Johnson's (1988) claim that metaphors are not a linguistic ornament but deeply embedded in everyday experience, as coherent systems organized around concepts. Metaphors are not matters of language but of thinking and cognition. Studies on children's understanding of metaphors (Gardner, 1974; Winner, Rosenthal and Gardner, 1976; Winner, 1979) were done with older, school-aged children but they have added extra insight to the present research. It was this research in particular that convinced me to prepare metaphors in which similarity was direct, immediate and substantial. In a method for use with preschool children talk about metaphors with an experimenter would be easy to support with colored pictures. It led the preparation of a quasi-experimental situation with an experimenter, a child and metaphors presented in pictures. To make this situation more ecologically valid and not to ask questions about metaphors directly we used a doll to speak for the experimenter. These kinds of pretend situations with a doll asking strange, silly questions about pictures were natural for children.

Subjects, research design and methods

We tested 120 children from 3 to 6 years (see table 1).

Children were tested individually during at least 2 sessions. They were administered with three different false belief tasks and the metaphor test which consisted of 10 metaphors. Usually the children were tested with two different false belief tests and half of the metaphors during one session, and a week later they were given the remaining tasks.

Table 2. Metaphors' test

Modality, base of similarity	Tenor	Tender	Question asked by doll	Type of metaphor
Vision modality, color	A girl dressed in green	A frog	Do you live in a lake?	A conventional metaphor: as green as a frog (here a literal translation from Polish)
Vision modality, color	A girl dressed in yellow	A lemon	Are you sour?	An original metaphor
Vision modality (size)	A very tall man	A giraffe	Do you live in a zoo	A conventional metaphor: as tall as a giraffe (here a literal translation from Polish)
Vision modality (size)	A very tall woman	A column	Do you support the roof?	An original metaphor
Vision modality (shape)	A boy with a rucksack	A camel	Do you live in a desert?	A conventional metaphor: as load as a camel (here a literal translation from Polish)
Vision modality (shape)	An elephant	A Hoover	Do you clean carpets?	An original metaphor
Kinaesthetic/motor movement modality	A very fat man running	A rolling barrel	Are you rolling?	A conventional metaphor: to roll like a barrel, to be as fat as a barrel (here a literal translation from Polish)
Kinaesthetic/motor movement modality	Merry-go-round with children	A mincer	Are you mincing?	An original metaphor
Tactile modality	A hedgehog	Syringes with needles	Do you give shots?	a conventional metaphor: as prickly as a needle (here a literal translation from Polish)
Tactile modality	A woman in a fur coat	A cat	Do you like to be petted?	An original metaphor



Figure 1. An example of pictures used to present a metaphor connected with color. The doll's question was: Do you live in a lake?

The first false belief test was an unexpected transfer test described as the classic one in the introduction. The second test was the deceptive box test (Perner, Leekman and Wimmer, 1987) in which the child was presented with a candy box which turned out to be full of pencils. At the beginning, the child was asked to say what he or she thought was in this box, then the child saw the unexpected content. The main question was: What will a friend of yours think is in the box when he sees it for the first time, like this, closed? To answer correctly the child has to know that a friend will hold a false belief of the content of the box. The third false belief test was very similar to the unexpected transfer, but was presented in colored pictures. It was a story of a hippo who was misled by feathers flowing behind the window. The hippo had a false belief about the weather and went out to ski. The child looked at the pictures and listened to the story and then had to justify the hippo's behavior and his surprise at seeing Teddy's mum beating a feather pillow at the window under his apartment. The main question was: Why was this hippo so surprised when he saw Teddy's mum beating a pillow?² A child could get 2 points for the correct answer in each test, so the maximum was 6 points.

Metaphors were presented in a color picture book 'read' together with a child and a doll. The child was encouraged to solve some riddles with a friendly experimenter. Each of the ten metaphors was presented in two pictures - one presenting the tenor (the topic of a metaphor), the other the tender (the vehicle). For example, the doll looked at the topic - a girl dressed in green, then at the vehicle - a frog, and then turned back to the picture of the topic and asked "the strange question". In this example, turning to the picture of the girl dressed in green the doll asked, "Do you live in a lake?". Then the experimenter asked the child the main test question, which was always the same in all metaphors: WHY COULD THIS DOLL ASK SOMETHING LIKE THAT? WHY DID SHE ASK THIS? Table 2 shows all the metaphors, with the questions asked by the doll. Figure 1 presents the example described above.

To answer the main test question the child has to perceive and understand the relation between the topic and the vehicle of the metaphor. Simultaneously, the child

² The procedure was presented more precisely in another article (Bialecka-Pikul, 1999).

Table 3. The criteria of assessment of children's answers in metaphor's test

Number of points	Description of answer
4 points	The child without any prompts uses conventional expressions justifying the doll's questions: e.g. "because the woman has a dress as green as a frog; "because the man is as tall as a giraffe"
3 points	The child says "because the woman has the same dress as the frog", "because she is dressed in green"; so he or she perceived the metaphorical similarity between tenor and tender in accordance with the assumed features. The child perceived significant common features of objects.
2 points	The perceived similarity is not in accordance with the premises taken into consideration during the construction of the method, but is seen in less obvious, detailed features of objects (in the kinaesthetic metaphor the child says: because the man has brown shoes like a barrel)
1 point	The child states that the basis of the doll's question is the set of pictures (e.g. "because there is a barrel and there is a man"). The justification is not full and it is not a verbalization of a metaphor. The answer is about the reality of the picture ("there is a frog and there is a girl") or the child's knowledge ("because a lemon is sour").
0 points	A child says nothing instead of reformulating and repeating the question or says "I do not know" or "Because she wanted to ask this"

has to take the perspective of another person (a doll). He or she should attribute a belief to the doll, but this belief could be invented only indirectly, on the basis of the perceived similarity.

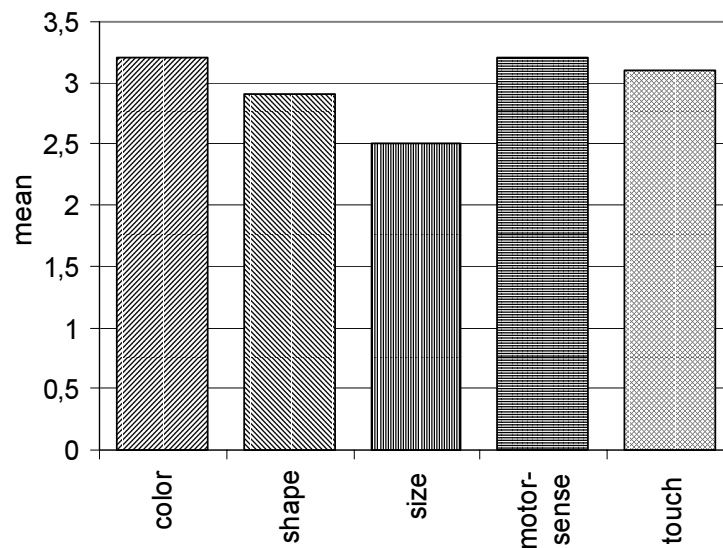
It has to be pointed out that because the material of metaphors allows a child to freely interpret the pictures and perceive the less important similarities, the presented metaphors didn't have to be read exclusively in concordance with the assumptions. Any perceived similarity, justifying a strange, silly question asked by the doll was assessed as understanding metaphors. The detailed criteria for assessment of the children's answers are presented in table 3.

The criteria were objectively assessed by three, independent, competent judges. Each judge assessed at least 20 protocols. The categorization turned out to be reliable and the agreement in judges' answers was high. W-Kendall's index was 0.86 – 0.96 for the individual items of the test and was significant.

Results

The presented method examines children's understanding of metaphor as an aspect of children's theories of mind, which was confirmed by the correlation between results obtained with this method and the results obtained with three different classic false belief tests. It was significant and middle (of 0.51 to 0.67, $p=0.01$).

Figure 2. Mean results according to kind of metaphor



The children were presented metaphors related to the basic senses, i.e. vision (here we have metaphors connected with three dimensions - color, size and shape), touch and movement. There were 10 metaphors, two of them always related to different senses (two- to color, two to size , two to shape, two tactile metaphors, and two related to movement; see Table 2). During the session the metaphors were mixed to avoid any kind of similarity between items. We hypothesized that similarity in color would be the easiest for children. But it turned out that although the easiest were “color metaphors”, the only significant difference was between metaphors connected with size and all the other kinds. This is shown in the Figure 2.

It could be said that the ability to perceive similarity between objects as the basis of the doll’s beliefs was independent of the modality that should be taken into account to see the similarity. Difficulties with metaphors connected with size were probably caused by the fact that the feature “size” is not absolute. To express this feature we drew a man against a door in the background (His head is below the frame) or a woman close to a bus stop sign (her head was at the same level as the sign). To perceive that they are really tall, a child has to see the relation between the frame or the road sign and the height of the person. It was certainly more difficult than just to see the colour of the dress. This shows how difficult it is to draw pictures of metaphors connected with different senses. But it is really worth doing, especially because of the children’s answers. For example, 5-years-old Ann looking at the picture of a giraffe and the tall man and commenting on the doll’s question (Do you live in a zoo?) said that the doll asked such a question: “Because she thought that the man was a giraffe” (and asked why she thought this) “Because he is tall

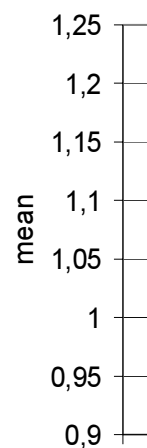
Figure 3. Understanding of conventional and original metaphors - mean result

and handsome”. The boy – Michael, also 5- years-old – looking at a picture of a column and a tall woman and then commenting on the doll’s question (Do you support/prop up a roof?) said that the doll could ask something like this, because “the woman is as tall as a column and she looks like a column and she is as thin as a rake”. The last part of this answer is especially interesting because, although the material did not suggest it, the child used a conventional expression, a common set combination of words that are frequently used in the Polish language (e.g. in Polish as thick as a barrel, the English equivalent being ‘as fat as butter’).

The metaphor test consists of five conventional metaphors which could be expressed in a common combination of words (in Polish - as green as a frog) and five original metaphors created for the purpose of the study, which had to be interpreted and are not used as set phrases in the Polish language (i.e. an elephant’s trunk as the pipe of a vacuum-cleaner). We assumed that conventional metaphors would be easier to perceive because linguistic knowledge influences the understanding of the world. The hypothesis was confirmed (see Figure 3). Conventional metaphors were easier for children.

To sum up, it could be said that prechool children are equally good at perceiving and understanding metaphors that refer to different modalities. Metaphors explicitly expressed in language are easier and more available to them.

³ For this analysis we treated correct answer from table 3 as always worth 2 points, a realistic answer as 1 point and 0 for “I do not know” or no answer.



To present changes in understanding metaphors in relation to age we calculated the r-Pearson's correlation index. Age was counted in months and metaphor understanding was calculated by the MET index (a range between 0 and 20 because there were 10 metaphors, each worth a maximum of 2 points³). The Pearson's index was 0.70 on $p < 0,05$ (the same index for the false beliefs tests was 0.76). Children's ability to represent beliefs of others in the domain of perceiving and understanding metaphors changes with age. Older children, 5 year olds, understood more metaphor.

We also checked how the relation between age and metaphors understanding changes, i.e. if this change is continuous or transitional. We calculated U-Mann's-Whitney's test for each pair of results (three- and four-year-olds, four- and five-year-olds and three- and five-year-olds) and the differences were significant (it was checked with Scheffe's test). It was thus shown that the relation between age and understanding beliefs is continuous. Trying to describe more precisely the shape of this relation it was checked if the increase between the results in three- and four-year-olds is the same as the increase between the results in four- and five-year-olds. Non-linear estimation allows one to compare the percentage of the explained variation for different models: linear, logarithmic, inversely proportional and exponential. It was found for the false belief tests and the metaphor test that the highest percentage of the explained variation is characterized by a linear model (57,6% i 49%). This result indicates that the development of children's theories of mind is a process of continuous change rather than a sudden cognitive transition.

Summary

To sum up it is worth emphasizing what was revealed in children's answers in terms of developmental trends.

First of all, it can be said that, in the development of understanding of the mental world in the domain of metaphors children go from more realistic and desirous to more relative and abstract answers which could indicate a more complex and complete understanding of the mental world of others. This result is in accordance with the thesis stated by Bartsch and Wellman (1995) or Mitchell (1997) and many other researchers on theories of mind that during the preschool years an important change in the child's knowledge about the mind occurs. We could observe this change in many natural situations and also measure it with a metaphor test, not only with a false belief test. Moreover, the constructed instrument is especially sensitive to an important aspect of the child's knowledge about the mind: the use of language.

The reported study can make a contribution to the discussion about the role of language in acquiring a theory of mind (see Siegal, 1999 with commentaries for review and discussion). After many studies (e.g. Jenkins & Astington, 1996; de Villiers & de Villiers, 1999) the pragmatic aspect of language is seen as an especially important factor in the child's competence to understand beliefs, desires and intentions of others (Deleau, 2003). It is worth mention by that asking a child the question: Why could this doll ask something like this?, why did she ask such a silly question?, we ask for justification of the doll's thoughts in a given situation. A child has to understand

the situation and, on the basis of the silly question, predict the belief of the doll and then give the arguments of the question. This is a really hard task measuring more than the use of language. A child has to analyze the use of language of another person, a doll. So it is a metapragmatic task. Analyzing the obtained results in relation to the role of language in theory of mind acquisition we emphasize the importance of metapragmatic competence. The results reveal that there is the difference in children's understanding of conventional and original metaphors and that is an additional insight on the presented claim. When a child uses language, he or she uses metaphors to talk about the world and he or she can more easily understand the thoughts of other people.

Secondly, we comment on difficulties in constructing ecologically valid methods to examine children's knowledge about the mind. The presented data show that it is very difficult to present metaphors in the form of a drawing and to picture metaphors connected with all modalities. Although the results are encouraging we need to work on a method to prepare tasks presenting other modalities, like taste or hearing.

Thirdly, it is worth mention that the metaphor test allowed us to analyze children's answers in many ways. Reading the protocols leads to conclusions that there are many kinds or types of children's answers. It is especially interesting to check if short answers (like: "Because the girl has a green dress") are less adequate, less precise than longer ones ("Because there is a frog and a girl dressed in green like a frog"). Longer answers justified the doll's questions in a more detailed way. From the linguistic point of view the first, shorter answer is even better than the second because it is an ellipsis. Maybe a child just uses the Quantity Maxim and makes the answer in a condensed form. Contrary to this, from the Karmiloff-Smith (1995) position, the second longer answer is a more explicit verbalization of the representation and is more mature. Checking if older children use the second kind of answer more frequently, we analyzed only protocols where children's answers consisted of more than half of the metaphors (we excluded protocols where children gave answers with less than 5 metaphors). We assessed shorter, implicit answers as 1 point and longer, more explicit as 2 points. The significant r-Pearson correlation index (0.61, $p < 0.05$) between age and mean of understanding all metaphors indicates that older children present longer, more complex justifications of the doll's questions. So shorter answers are only seemingly an ellipse. They are just less precise, less explicit. This easy statistical analysis should be treated as a preliminary result in this complicated matter, but it shows the advantages as well as the disadvantages of this kind of method. Using methods where children are not answering "yes" or "no" questions leaves researchers with far more rich material, but sometimes also more difficult to interpret.

To sum up, the presented study can be seen as a contribution to discussion on the nature of the developmental course in the domain of theories of mind. In the light of these results the development of understanding of the mind is a process of continuous changes that are probably linear. The idea that between the age of 3 and 5 we observe a sudden cognitive shift is no longer valid. The continuity of the change encourages us to think about competencies of older children, adolescents, and even adults. The probability that important uncovered changes take place later is high. Moreover, it inevitably leads to the question about the role of knowledge about mind in development. Such key developmental question provides a broader perspective for future research.

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