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Investigating the way 5-years old children distinguish the concepts 'object' and 'material' Is the 'material' overshadowed by the 'object'?

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Abstract. This paper reports on a study of 5-year-old children ability to distinguish the concepts 'material' and 'object'. The aim of this study is to investigate how children of this age conceptualize these concepts along with their communication ability, the criteria they use to identify object and material and whether their criteria are relating to extensive or intensive properties. For this purpose, three tasks of different complexity contexts were implemented by using objects and materials of daily life. The sample of the study consists of 30 5-years old children. Data were collected through semi-structured interviews. The analysis of the data revealed that the way children conceptualize 'object' and 'material' is related with their communication ability, they have used extensive or intensive properties as criteria to identify and distinguish objects from materials. Moreover, when objects and materials were explicit children were able to distinguish them. In reverse, when objects consists of various characteristics 'material' was overshadowed by the 'object'.

Keywords: Material, object, distinguish, early-childhood.

Introduction

Students' understanding of phenomena is one of the main targets in science education. So the nature of the materials involved should be comprehensible to a satisfying degree. Young children have experiences of their physical environment through objects and the various materials they are made of. Thus, the way they identify and distinguish them is considerable for preschool educator in order to organize science and environmental activities involving appropriate materials and objects.

Johnson (1996, 1998 & 2000) and (Solomonidou & Stavridou, 2000) suggest knowing materials presupposes the clarification of basic concepts. When, for instance, one cannot evaluate whether a property is due to the substance or due to the object, then it is not clear what the change of this property means, i.e. a change of substances during the phenomenon means a chemical change, whereas a change of only the object (form) means a physical one.

Moreover, lack of distinction between object and material is quite common; it begins from early young ages with material and object being interlinked and still exists in adolescence and beyond. As Piaget (1972) pointed out, concepts occur in children through the development of the basic ontological categories cause, object, space and time. So the classification's criteria which children use to define material and object

seem to be important for the particular concepts development and further for their science education.

Children experience objects putting them into groups according to their common attributes (Spelke, Kestenbaum, Simons & Wein, 1995). Typically, these categories could be ontologically distinct and they can form certain concepts (Chi, Slotta, & de Leeuw, 1994; Keil, 1989; Slotta, Chi & Joram, 1995). The difficulty in making distinction between materials and object is probably due to their limited ability to work at the macroscopic level, studying macroscopic properties, whereas it can be improved in older ages when their ability to work also at microscopic level has been developed (Dickinson, 1987; Driver, Squires, Rushworth & Wood-Robinson, 2000; Krnel, Watson, & Glazar, 1998).

In any case, age is one of the major factors affecting children's ability to describe and identify materials and objects, contributing in the distinction between them, although education factors, such as school science curriculum and relevant instructions, could also be significant (Krnel et al. 1998; Krnel & Glazar, 2003; Liu & Lesniac, 2006; Michaels, Shouse & Schweingruber 2008; Slotta et al. 1995; Smith, Wiser, Anderson & Krajicik, 2006). Other factors are the size of the object made by a material, the children's familiarity with a certain object and the form of a material (continuous form, powder, etc). Younger children made relevant classifications using a mixture of properties of objects and materials. On this basis when classification is applied on solids, the concept of object is clear and distinct (Saxe, Tzelnic & Carey, 2006). Even among solids criteria are posed easier on compact than on the flexible, powdered, or non-rigid ones (Huntley-Fenner, Carey & Solimundo, 2002; Kalish & Gelman, 1992; Kobayashi, 1997).

As far as criteria and change in the form of objects are concerned, the situation is even more complicated. In particular, contradictory results were found for the infants' ability to identify the materials after cutting the objects into pieces (Dickinson, 1987; Driver et al. 2000; Smith, Solomon & Carey, 2005). Infants of 4 years old when an object was transformed could not see what did changed and what (Michaels et al., 2008) remained.

Further to the above when such studies approach early ages, verbal communication is also an important issue (Gelman & Bloom, 2000; Goswami, 1998; Keil 1989; Mitchell & Riggs, 2000). The development of language makes this explicit. Krnel et al (2003) came to the conclusion that initially children of early age classify easier than verbalize in a sufficient way even though they confirm good communication skills by checking parents' education and mother language. The lack of knowledge of specific words could be a significant factor affecting the validity and the reliability of what is recorded and evaluated. While an argument is taking place is possible due to false categorizations, difficulties in the use of appropriate words "naïve essentialism" to arise (Dickinson, 1987; Gelman & Bloom, 2000; Hicling & Wellman, 2001; Kobayashi, 1997). Additionally, it is also considered that children resist to suggestions and they are suspicious to questions playing the game of right or wrong ones (Birbeck & Murray, 2007). Consequently, all these make things even more complicated and relevant research evidence should be examined as possibly insufficient or under verification. In this paper verbal communication is tried to be measured by the number of ontological categories recalled to children's mind when specific pictures are shown to them (Cole & Cole, 2000).

In this context and due to the complexity and the importance of this topic for the understanding of further domains such as environment, physical and chemical changes, sustainability, the matter concept, it was considered as very important to

further study it, focusing on how five years old preschoolers think and argue when objects made of specific materials are presented to them under certain circumstances, asking for identification and classification.
This study aims to: a) investigate how five years old children conceptualize the concept 'material' and object' and how they distinguish them, b) the criteria they use to identify material and objects and c) whether the criteria they use are relating to generally characteristics or to extensive or intensive properties of 'object' and 'material'. The verbal communication ability of the children was also evaluated.

Research purpose
Although, the concept of object is related in fact to three other main concepts i.e., the 'material' from which is made of, its 'design' and the 'amount' of the material (Johnson 1996, 2000) we made a simplification: As it is about a preschoolers' study, we focused only on the shape (instead of the entire characteristics of a design) and on compact objects, which means that the 'amount' of the material could be replaced by the simpler concept of the 'size' (since, in that case, 'amount' and 'size' are analogous to each other). As a result, we assume that the concept of object can be mainly characterized by: a) The 'material' b) the 'shape' c) the 'size'
Other characteristics or properties of an object made by a specific material were considered as secondary additional characteristics. For instance, the 'color' is in fact a property of a material, which can differentiate the material (for example, different colors in metallic objects indicate different metals, like silver vs. copper). However, for simplicity reasons and taking into account the age of the children, we assumed that all metals, independently of their exact composition (silver, copper, iron, etc) and thus their color, they are considered as one material (metal).
In the above context the following research questions can be recognized:

- How children of that age recognize and classify objects made of specific materials. Which criteria do they use for such classifications?
- How children's classifications are affected by the complexity of the case (number of the objects and the materials or transformation of the object)?
- Whether verbal communication affects children's answers.

Method
Sample
The participants were 30 five-year-old children (15 boys and 15 girls). All children were second grade preschoolers. The particular preschool center had five classes of 25 students each. So we interviewed six children of each class. Especially we picked them up from every class by the alphabetic catalogue choosing the first, the forth and the seventh girl and the same procedure for the boys. The sample described well social and demographic data. All children lived in urban environment; spoke the official language as mother language. They all had parents graduated of secondary and higher education, aged of 22 to 41.
Instrument
The collection of the data was based on a number of semi-structured interviews, which in fact were conversations with the preschoolers in a semi-structured form (Mason, 2003).
Before the main part of the interview, the communication ability was evaluated. Five photos were presented to the children, in each one of which, a particular item (without any background) was pictured: a shark (photo 1), a parrot (photo 2), a tin of Cola (photo 3), a fir tree (photo 4) and a boy playing with bubbles (photo 5). The children

were asked to express what they see in the photo. However, in fact, for each one of the items pictured in the corresponding photos, a particular number of 'ontological categories' were preset. In particular, they were as follows:

i) For photo 1: shark, fish, animal, carnivore
ii) For photo 2: animal, bird
iii) For photo 3: tin, refreshment, coke, beverage
iv) For photo 4: plant, tree, Christmas tree
v) For photo 5: joy, sadness

Thus, 15 ontological categories were preset for all the five items. For the evaluation of the children's verbal communication ability, we counted every expression that fits to any of these preset ontological categories Slotta et al (1995). Any other irrelevant description was rejected.

The main part of the protocol includes three tasks. In each one of the tasks 1 and 2, the children were asked a) to recognize a number of objects made of particular materials, b) to classify the objects explaining their criteria and c) to classify again the objects in a different way – if they could – explaining again their new criteria. In task 3, the children were asked to recognize similarities and differences between an initial object and its pieces after cutting. All the objects, together with their materials, were common and familiar to the children.

Task 1

For the implementation of task 1, the objects made of the materials that are presented in Table 1 were used.

Table 1

The objects that are used in task 1

	Spoon	**Plate**	**Glass**
Metal (metallic color)	√	√	√
Glassy (no color)	√	√	√
Plastic (white color)	√	√	√

All the nine objects were initially in a box. Each one of the children was asked to take them out and to put them on the table before questioning. The protocol of the interviews includes the following procedure:

1. Putting the objects into groups
2. Explain why.
3. After a disarrangement, putting again the objects into (new) groups
4. Explain again way.

Task 2

For the implementation of task 2, the objects made of the materials that are presented in Table 2 were used. In this task, it is actually a study of twelve different objects, since there were three different colors in each one of the materials. Thus, although the overall complexity of the classification was increased, it was more possible for the children to use the material as a criterion (due to material common characteristics), since the objects were significantly different in their other main characteristics (the shape and the size). However, apart from these main characteristics, other secondary characteristic or properties could be criteria for classification of the objects by the

children, like the color. The latter was common in a number of objects e.g., in a wooden red wheel, in a plastic red baby rattle or in a red doll's t-shirt.

Table 2
The objects that were used in task 2

	Spoon	Tin	Key	Wheel	Doll	Pencil	Bin	Rattle	Scissors	T-shirt	Glove	Piece
Metal (different colors)	√	√	√									
Wood (different colors)				√	√	√						
Plastic (different colors)							√	√	√			
Cloth (different colors)										√	√	√

Also in task 2, all the objects were initially in a box. Each one of the children was asked to take them out and to put them on the table before questioning. The protocol of the interviews includes the same procedure as in the case of Task 1.

Task 3

In this task, two objects, namely a plastic glass and a paper plate, were presented to the children before and after cutting into pieces. Children were asked to recognize the materials after cutting and to state similarities and differences in comparison to the initial objects.

Each interview lasted about 50 minutes and it was audio recorded. Data were qualitatively analyzed, although they were also statistically elaborated after coding.

Procedure

The final form of the research tool, including the objects and the materials that were used, was designed after a pilot study. In the pilot study, two infants, a five-year-old boy and a five-year-old girl, were interviewed. During the procedure it was clearly noticed that some objects and materials had to be modified in order to record responses that ensures data. After the necessary changes we proceed to the main study. To be more specific the first metal plate was not recognized easy as a plate. The round shape made it look more like a cover pan. We also changed the metal tin with an empty one. The tin in the pilot was full as we had decided to use covered materials. The content distracted the children and they seemed to be more interested to find what is inside than focus to the groups they were told to make.

Results and Discussion

When interviewing five years old preschoolers, data collection could be tricky since their answers cannot always express their thoughts. In order to minimize such a risk, the ability of children's verbal communication was examined, by the using the photos described above. Although each photo pictured a particular item without any background, a number of additional descriptions were emerged and recorded (further to the expected ontological categories). Thus, for the first photo (a shark), children's descriptions included words like sea, water, big sharp teeth, color blue, it eats human flesh, it looks like dolphins or whales, white shark, etc. In the second photo with the fir tree, children described it as a Christmas tree and mentioned some characteristics

like color green, Christmas balls, branches and leaves, soil and woods. The photo with the refreshment was described as cola tin, refreshment, a metal box, soda, something red, like beer, being cool, something that adults drink. In the fourth photo picturing a parrot, children described it mainly as a bird and wild animal. Furthermore they mentioned characteristics such as, it is like chicken, like pigeon, it talks, it is green, it flies, it is a night bird and it has feathers and a beak. In the last photo (a boy playing with bubbles) children described a boy who, is playing with the bubbles, is joyful, feels good, laughs and likes what he does.

Apart from the above descriptions, children did express and describe the expected ontological categories. They used the expected words which indicate the ontological categories a fir tree, a cola, a parrot. Some of them used more than one word to describe the photo: «A shark, it is dangerous, it eats fishes, dolphins and men. Boy No3» «It is a parrot… an animal… like a chicken…Boy No 4» «A tree…a Christmas tree…with green leaves Girl No 21». The majority of them used the exact words we expected to. They seem to handle ordinary ontological categories in a sufficient way adding words strongly connected to the photos. Counting every child's description that fits to a corresponding category, a total score was recorded for each one of them.

The results of the analysis indicated that two of the children were able to express and describe 5, 7 or 8 ontological categories, while five of them did express and describe 9, 10 or 12. Seven children did describe 11 and only one of them express 13 or 14 ontological categories.

Based on the logic of the quartiles (25%, 50%, 25%) of the distribution of 'children's verbal communication ability', as it is presented in the Figure 1, we tried to distinguish children in three main categories, 'Low Level' category (LL), 'Medium Level' (ML) category and 'High Level' category (HL). However, due to inconvenience in fitting these percentages in the numbers expressing the children's ability, it comprised 6 children in LL, 17 in ML and 7 in HL category respectively. The corresponding children's verbal communication ability is 0-8 for LL, 9-11 for ML and 12-14 for HL.

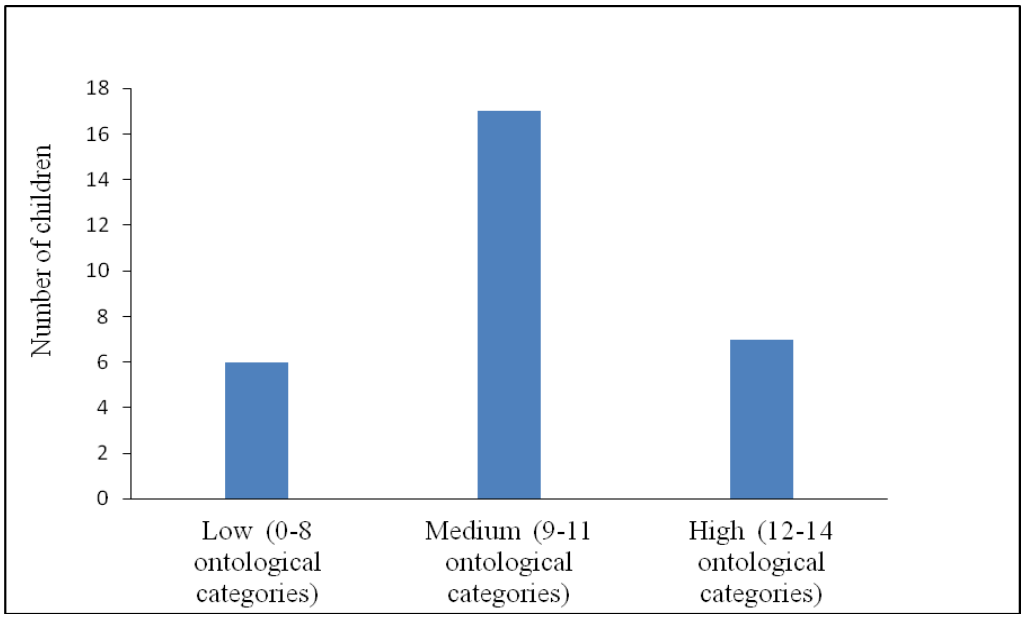

Figure 1: ***An overview of children's verbal communication ability's categories***

Besides, the categorization of the sample in 'LL', 'ML' and 'HL' in that context did not really help in clarifying the main question of this study. Although one can see differences among them throughout the three recognition and classification tasks, we

could not find any specific relevant correlation. For instance, maybe it is not random that in all these tasks and subtasks, only one 'LL' preschooler in one subtask (see last Table 6) recognized an 'object made by a material' whereas in all the other cases the 'LL' preschoolers of the sample recognized and categorized only either a 'material' or an 'object'; however the picture is not clear also in the other two categories ('ML' and 'HL').

Task 1

When the 9 objects of task 1 were put on the table (see Table 1), children were asked to recognize them, naming every one of them. There was a variety of designations in their responses, since many children designated in some cases only the material of the object (e.g. this is plastic), in some other cases only the object (e.g. it is spoon) and in some cases both of them (e.g. a glassy plate). In Table 3, one can see the number of designations in children's recognitions (object – material – object made by a material) and one who gave no designation of any kind of recognition.

Table 3

The number of children's responses in each of the cases of task 1 (recognition, 1st classification, 2nd classification)

	Recognition			**1st Classification**					**2nd Classification**				
	Material	Object	object made by a material	Material	Object	object made by a material	Utility	Properties	Material	Object	object made by a material	Utility	Properties
Number of LL Children	4	5	0	3	1	0	1	2	3	0	0	1	3
Number of ML Children	12	11	2	7	6	1	4	12	10	1	1	4	8
Number of HL Children	6	3	1	1	2	0	3	5	5	0	0	2	3
Total Number of Children	22	19	3	11	9	1	8	19	18	1	1	7	14

As one can see in Table 3, the designations are numerous, since many children used more than one designation in order to recognize the 9 objects, i.e. in some cases they

recognized them as objects, in some others as materials and in some others as objects made by a specific material. Some relevant examples are given below:
"*These are plates and spoons…*" [Boy No14], he recognises in a very clear way the specific objects and insists on the plural of the words plate and spoon. "*A glass like a mirror, a glass, a spoon, plastic spoon and a plastic plate…*" [Girl No 2] this child seems to recognize the objects based first on material, afterwards on object only and then continues with both of them.
When children were asked to put the nine objects into groups, there was also a variety of classifications in each case. Some of the children (one of the ML category and especially three of the LL category), did not understand the procedure that is asked and further instructions had been given. The final results of the children's 1st classification are presented in Table 3. As one can see there were four criteria that was used by the children: The first included verbal references about material as: "iron, plastic, glassy, metal, bronze, paper, something like metal, tin". The second category included verbal references about objects as "plates, glasses, spoons". The third category included verbal references about properties as: (color) white, grey, silver, gold, dark, the same color, (hardness) hard, (fragility) it can break, (sparkle) shiny, like a torch, like a mirror, (sound) they have the same noise, because they hurtle the same, (scheme) is round, because they stand. The fourth category included verbal references about utility as: because we eat food with the spoon, we can stir the coffee, we eat cakes, we drink juices, I thought it was tea and we sip a little.
However, similarly to recognition, also in 1st classification, there were many cases where the same child used more than one criterion. For example: When girl No 7 was asked why she had put particular objects together firstly she said "*because they are white and white*" focusing obviously on the property of color. Trying to explain the other groups that she had made, she said "*they are plastic… they are glassy… they are iron*". Another child, Girl No15, made a group of three glasses and said that "*this one is tough and the other one is tough, they are glassy and also they are making the same noise*".
An overview of children's criteria in this 1st classification shows that children use mostly the criterion of 'properties' for such a classification, whereas also the criteria of material and object are used quite often. They used less the criterion of utility.
The next step of Task 1 was to rearrange the nine objects on the table and ask every child to try again to put them into new groups so that they have something in common. The results were different in this second attempt of classification (see Table 4). Although a number of children used again more than one criterion in order to accomplish this 2nd classification, many children could not proceed to a new classification. Comparing children's criteria in this 2nd classification with those in the 1st classification, one can see that the criterion of material is used more often, whereas the criteria of properties and object are used less.
The criterion of 'properties' is the most frequent during both the classifications, following by the criterion of 'material', whereas third is the criterion of 'object'. Only one child in each classification referred to an 'object made by a material', indicating perhaps that such multiple criteria are quite sophisticated for them. It is also noticeable that a half of the children remained steady in their preferences along the classifications. Particularly, 7 children used the 'material' as criterion of classification, 1 the 'utility', 7 the 'properties' and 11 children used more than one. Some changes in their preferences were: from object to material 2 children, from material to object 2, from material to more than one 1. In addition, when the criterion in the 1st classification was the 'material', the 'properties' was in the 2nd one. When the criterion in the 1st classification was the 'object', the utility usually follows in the 2nd one.

When the above findings were related to those of children's verbal communication ability, some interesting relations were found (see Table 4). Since all the ML and HL children had reported 9 to 14 ontological categories in their descriptions, it was expected that they probably would follow this initial tendency also when they use and define categories over recognition, 1st and 2nd classification. However, this did not happen as they seem to be rather laconic. As for the use of the criteria, the criterion of 'material' was present over the three levels, although the children of LL also preferred to use the criteria of 'utility' and 'properties' more often than the other two levels. In addition, although we expect that the 'level of communication' could also affect the use of the criterion of 'object made by a material', the analysis showed that children did not use it no matter the level they belonged (to), (with) the exception of five times.

Task 2

In this task, there were 12 objects on the table (see table 2) and children were asked first to recognize them, naming every one of them, and then to classify them in two attempts. Again, there was a variety of designations in their recognitions, as one can see in Table 4.

Table 4

The number of children's responses in each case of task 2 (recognition, 1st classification, 2nd classification)

	Recognition			**1st Classification**					**2nd Classification**				
	Material	Object	object made by a material	Material	Object	object made by a material	Utility	Properties	Material	Object	object made by a material	Utility	Properties
Number of LL Children	0	5	0	3	0	0	3	6	1	0	0	1	3
Number of ML Children	1	14	6	5	0	0	8	10	5	0	0	7	9
Number of HL Children	0	7	3	4	0	1	4	12	1	1	0	2	2
Total Number of Children	1	26	10	12	0	1	15	28	7	1	0	10	14

Since in this task, there were 12 different objects, this criterion (of the 'object') is present in almost all children's responses. They recognized all the given items as objects. However, a number of children used the 'object made by a material' criterion, whereas one child referred to 'material'. The 'object made by a material' was

recognized in cases of the 'plastic ball', 'wooden toy' and the 'iron bottle', where the material was more obvious to observe it and to combine it with the object. On the contrary, the 'red wooden wheel' was mostly recognized as a circle.

Although the same reason as previously in recognition, i.e. there were 12 different objects, in the 1st and the 2nd classifications of this 2nd task, the criterion of 'object' was almost absent in children's justifications. The massive use of criterion of the 'object' in recognition was not followed by a similar tendency afterwards in classifications. On the contrary, the criteria that dominated were properties and utility. (See also Table 5)

In the 1st classification 15 children's statements were with the 'utility' of the objects. Their answers included verbal references to how can objects be used. Such an extract is following [Boy No1]:

- Put them into groups to have something in common. Why did you put these together (glove, spoon, key, t-shirt, pencil and one left aside).

- We wear this t-shirt. We get something with this. This is a box to put things inside. This is a toy and another toy.

The criterion of 'properties' was used by 28 children, including verbal references about 'color'. They mentioned some colors and the word '*color*' itself. An extract is given below [Girl No 5]:

- Why did you put these together? (Pencil, t-shirt, baby rattle)

- They are red.

- And why these? (Spoon key, tin)

- They have the same color grey.

- And why these? (Pencil, toy doll)

- They are like grey and like grey. Same color

- Why did you put these together? (Glove, cloth)

- Same color.

Generally, in their descriptions, children were using the exact words like *wooden, wool, glass, steel* or *plastic* for 'material' or particular colors for the property of 'color', as well as they were using verbs like eat, keeps us warm, etc for 'utility'. As for the procedure that the children followed during the first grouping, this appears to have some particular steps. Initially, they put the objects in numerous groups. They described their reasoning, talking bout properties for every single object. Then they made comparisons, managing to notice as more common characteristics as possible. The resulting small groups had usually two objects in some occasions three and some times an object was left to be the last one apart from the others. The 'properties' that had been referred by the children, mostly concerned the 'color', the 'hardness' the 'fragility', the 'sound' or some 'characteristics of the design' e.g. , "they are hard" [Boy No27], "…the end of scissors will break" [Girl No24], "…it is the same sound" [Girl No24] "they have heads" [Boy No30]. The 'utility' was described for each one "the glove is used for the cold and the key to unlock the door" [Girl No24]. When they discussed about pairs they had reasoning like "because scissors cut the cloth" [Boy No29], whereas when they discussed about triads or more, they began to make a story "A man wears the t-shirt, gets out of his home with his key and his suitcase [Boy No11].

For the needs of the 2nd classification of task 2, we rearranged the objects on the table and asked the children to try again to put them into new groups, thinking if they have something in common. The categories were then similar to the first grouping i.e., 'object', 'material', 'object made by material', 'properties' and 'utility' as Table 5 shows. A new finding at this stage was that, 8 children did not make any groups. Even though we gave instructions again, they could not make any progress. A careful look at the answers of these children in their first classification of task 2 shows that they

used more than one criterion. This means that they maybe used up all the possible criteria they could think of and any further encouragement would be meaningless. Furthermore, the grouping at this second attempt, followed the same pattern as in the first one as for the distribution of the children into the categories. Thus, although the majority of the children applied all the criteria, when the criterion of 'material' was the dominant one, the second choice was the 'properties'; when the dominant criterion was the 'object', the second was the 'utility'. Generally, the number of criteria was increased as the children moved from the recognition to the 1st and 2nd classifications i.e., in both classification they used much more criteria even in cases of children who were laconic in recognition. There were only two exceptions in children, who steadily were choosing the 'material' and the 'utility' throughout the procedure.

Comparing the above findings to those of task 1, one can see that the criterion of 'material' is not the most preferable as it was possibly expected. Since the criterion of 'object' is constrained by the use of 12 different objects in this task 2, the use of 'material' could be more massive in comparison to the task 1. However, many of the materials used in this task 2 were 'covered', as they were presented in the way they appear to be in everyday life, e.g. colored wooden toy. This was maybe the reason for a different procedure in their evaluation and classification and for the promotion of other criteria such 'properties' and 'utility'. Simple forms of materials, such the metal tin and the metal key facilitated its recognition and thus, in those cases the 'material' dominated as a criterion.

When the above findings for task 2 were related to those of children's verbal communication ability, no clear relations were found (see also Table 5). This could be expected, as in this task 2 there were 12 different objects. Thus, all the children, no matter their level of verbal communication, chose in first recognition the criterion of 'object'. During the grouping, they all chose 'properties' and 'utility' as criteria and not 'material', 'object' or 'object made by a material'. In addition, the level of communication seems to be in unexpected analogy with their choices. Children with LL and HL chose firstly one criterion and steadily remained to one or two criteria no matter their ability to use categories.

Task 3

Initially, a paper plate and the same paper plate cut to pieces were put on the table. Children were asked to recognize them and to refer differences and similarities justifying their responses.

Table 5

The number of children's responses in case of paper plate of task 3 (recognition, differences and similarities)

	Recognition	**Differences**	**Similarities**
	Pre- cutting	**Post- cutting**	**Post- cutting**

	Material	Object	object made by a material	Yes-differ (no justification)	No-differ (no justification)	Different due to material	Different due to new status	Different due to properties	Yes-same (no justification)	No-same (no justification)	Similar due to material	Similar due to new status	Similar due to properties
Number of LL Children	5	6	0	0	4	0	1	0	3	1	0	1	1
Number of ML Children	14	15	2	0	6	1	4	6	1	5	2	2	5
Number of HL Children	7	7	0	1	1	1	4	0	0	2	0	2	3
Total Number of Children	26	28	2	1	11	2	9	6	4	8	2	5	9

As Table 5 shows, the majority of the children recognized both, the paper plate and the same paper plate cut to pieces as "paper" or "plate" whereas only few as "paper plate". As for the differences and the similarities between the paper plate and the same paper plate cut to pieces, children were mostly responded without justifications. When there were justifications, they were mostly due to the 'properties' like the 'color' and less due to new status, i.e. children mentioned the words "*cut*" or "*piece*". Only in few cases, they were based on the 'material'. The justifications were in general short and some examples are given below:

"Let me show you something else now. What is it?
It is a plate.
What is made off?
It is made of paper.
[We are cutting it] Have they anything in common?
No.
Have they something different?
It is cut. [Girl No7]
What is it?
It is a plate.
"What is made off?"
It is made of plastic.
[We are cutting it] Have they anything in common?
They have.
What?
This is cut. We can put it together.
Have they something different?

No [Girl No9]
Further to the above, a plastic glass and the same plastic glass cut to pieces were put on the table. Children were asked again to recognize them and to refer differences and similarities justifying their responses.

Table 6
The number of children's responses in case of plastic glass of task 3 (recognition, differences and similarities)

	Recognition Pre- cutting				**Differences Post- cutting**				**Similarities Post- cutting**				
	Material	Object	object made by a material	Yes-differ (no justification)	No-differ (no justification)	Different due to material	Different due to new status	Different due to properties	Yes-same (no justification)	No-same(no justification)	Similar due to material	Similar due to new status	Similar due to properties
Number of LL Children	4	5	1	0	4	0	2	0	1	0	0	0	2
Number of ML Children	10	11	4	1	8	0	7	1	1	7	0	3	5
Number of HL Children	6	6	1	0	2	0	5	1	0	4	1	3	2
Total Number of Children	20	22	6	1	14		14	2	2	11	1	6	9

As Table 6 shows, the results are similar to the previous procedure with the plate. Many of the children recognized both, the plastic glass and the same plastic glass cut to pieces as 'objects' or 'materials' and less of them as 'plastic glass'. As for the differences and the similarities between them, again children were mostly responded without justifications. May be it is difficult to answer this kind of questions in a clear way. In general terms, similarities as 'color' seem to be easier to be found. Color is the most used characteristic in that case of similarities. In differences children only mentioned that the object was afterwards cut in pieces. It was not found a straight answer about the lost shape in a cut object; possibly, it is implied in answers like "*it is cut*" or "*it is in pieces*".
The cutting of the object did not really change the whole picture as it is formed so far. Although the majority of the children could affirm the existence of differences and similarities pre and post cutting, they could not give more information about them, and words like '*it is the same material*' was not clearly recorded. Children rather observed the changes in the form of the objects and in some occasions they talked

about the new status (e.g. *it is cut, it is a piece*) in terms of new object characteristics, advocating the priority of the object in such ages (Dickinson, 1987).
When the above findings were related to those of children's verbal communication ability, no significant relationship was found. The majority of the children provided justifications in a similar way. (See Tables 5 and 6)

Conclusions

Children conceptualize 'material' and 'object' when they act on objects made of by various materials. As far as the recognition of the objects made by specific materials is concerned, it seems that preschoolers tend to recognize and name, either, objects or materials rather than objects made by materials. When the possibilities are equal for the two concepts, as in task 1 where there is in fact a combination of three objects by three materials, children almost equally recognize the object or the material without be able to specify any particular reason. A similar distribution between the two concepts holds true for the recognition of task 3, although there are some children in that task naming objects made by materials. On the contrary, when different object are present, as in task 2, children focus on the objects at the first place, whereas material seems to be a second option for them. As a result, children recognize the material only when first have recognized the object and thus, there are children referring to objects made by materials in this case. Maybe this originates from the young ages, where, as Dickinson (1987) reports, children have already developed a primarily knowledge of objects, in contrast to the material that even in the age of 9-10 is overshadowed by the object.
The same sense concerning an overshadowing of the material by the object one may has when studying the results concerning the classifications of *task 1* and *2*. In *task 1* where the possibilities for the two concepts are equal, children did use them equally, although the dominant criterion is a mixture of properties of objects and materials, as in the research of Krnel and Glazar (2003), following by the criterion of utility. The material starts to take the advantage as criterion in comparison to the object in the 2nd classification, when children were looking for alternative criteria, showing probably that the material is not a priority for them as criterion. On the contrary, utility and mainly properties still are intensively present although there is a fade in their appearance.
The above thoughts are also supported by the results of the *task 2*. In the first classification of the *task 2,* where 12 different objects are under classification, it was expected that material would be the dominant criterion. Although, children responses reveal material as a significant criterion, indeed, properties and utility were again the dominant criteria. In addition, properties of the material (mainly the color) seem to take the advantage. Almost the same is the picture in the 2nd classification and, although children had fewer choices in that classification, material did not take any advantage. In sort, in accordance to other researches (e.g., Krnel et al. 1998; Krnel and Glazar 2003), it seems that the material is not an easy choice as criterion for such classifications by the 5 years old preschoolers.
The evaluation of the children's verbal communication ability revealed many kinds of expressions and descriptions related to the items pictured in the photos. Although the children's distribution of Figure 1 is in line with a number of researchers' thoughts (Dickinson, 1987; Gelman & Bloom, 2000; Kobayashi, 1997) about the existence of children's difficulties in the use of appropriate words, these difficulties seem to be limited and the number of the preschoolers with low level of communication was rather expected. On the contrary, the majority of them did express and describe the

preset categories and in some cases, with more than the expected words. This could positively affect the validity and the reliability of the study, although in such cases any relevant conclusion should be under further investigation (Birbeck & Murray, 2007). Nevertheless, it seems that the simplicity or the complexity of the whole context of the tasks does not really affected children's priorities in the criteria posed for such classifications. The material appears to be overshadowed by the object in this age and, in line with the relevant researches, it probably follows the cognitive development of each child. However, if one thinks about the importance of these two concepts for the understanding of many other topics in science education, the question that could pose here is how science educators could help children to clear things up – a question for further investigation.

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