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SENSITIVITY TO COMMUNICATION CONTEXT IN 3–4-YEAR OLD CHILDREN DURING NEW WORD LEARNING

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Abstract

This research tests the hypothesis that 3- and 4-year-olds can use characteristics of a social context created by adults to learn new words. One of the strategies that a child can use in multiparty conversations is to decide to whom a message (and a new word) is addressed. The ability to do so may simplify word learning situations by making the learning selective and by reducing the amount of perceived words. In the current experiment we test children's ability to learn a new word from a natural conversation when the communicative context is kept constant and when it is altered by adding a new game partner. We predicted that children will differentially interpret verbal messages containing a new word as addressed to them or to the new person, and this will affect their ability to remember the new word. Children heard a new word in one of two conditions: when a communicative context shared with an adult was kept constant and when it has changed (a new adult joined the conversation). We found that 3-year-olds could learn new words only when the communicative context was constant, but 4-year-olds could learn new words in both conditions. A control condition revealed that these findings cannot be explained by task difficulty.

Keywords: language development, word learning, social cues, communicative context, memory.

Children are expert word learners. They approach the task of mapping sound forms to pieces of visual information with a number of strategies and principles. For example, children assume that new words most likely refer to hole objects rather than its parts or properties (whole object assumption; Markman, 1991). Children assume that new words refer to novel objects, and one object cannot have two labels (mutual exclusivity; Merriman & Bowman, 1989). Children also extend new words to other tokens of the same

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category based on colour or shape similarity (Carey & Bartlett, 1978; Landau, Smith, & Jones, 1998). All these findings, however, were obtained in situations when the named objects were perceptually salient and stood out in naming contexts (Vlach & Sandhofer, 2011). This does not always apply to natural word learning situations. In real life objects are rarely isolated. Instead, they frequently appear among other objects as parts of a child's activity. In the current research we investigate children's ability to rely on subtle characteristics of social contexts to figure out meanings of new words.

Previous research shows that young children are sensitive to social information in word learning situations to infer the speaker's referential intent. For example children can take into account the speaker's previous experience with objects to identify the referent of a new word. Children as young as 1 year of age can remember what the speaker has and has not already seen and use this knowledge to interpret subsequent reference. If the speaker is excited children interpret their reference as about a new object they have not seen yet (Tomasello & Haberl, 2003). Additionally, children as young as 13 months can map a new word to its referent only if naming is accompanied by looking and pointing to the object. If an adult looks away while saying a new word children don't map this word to the object even if they were looking at the object themselves at that time (Woodward, 2004).

The speaker's knowledge state and communicative intention is not the only kind of social information that children rely on in word learning situations. Around 2 years of age children become sensitive to the conventionality assumption — the idea that word meanings are not person-specific, but are rather shared between all adults. For example, in Henderson and Graham study (2005) 2-year-old children were asked to find an object named by the experimenter with a novel word. The experimenter then left, and a new person came in and asked the child to give him that object. Children younger than 2 years did not succeed at this task suggesting they do not yet understand that word meanings are shared between different adults. Children of 2 years and older could successfully identify the target suggesting they do not only rely on pure associations between people, words and objects, but have a deeper social understanding of reference and its conventionality.

Interestingly, 3 year olds understand that not all the utterances of an adult are conventional, i.e. their meanings do not have to be known by all members of the linguistic community. Sometimes a word might have a meaning known only to the person who uses it and to their listener. Thus, in the Diesendruck and Markson experiment (2001) 3-year-old children saw two novel objects, one of which was named by a new word (for example "zev"). After that, a toy puppet appeared (who did not hear the naming) and asked the child to give her one of the objects using another new word (for example, "dax"). If children interpreted the new word as conventional, known to all native speakers, — not only to those present in the situation, — they would choose the second object, not named by the first word, according to the principle of mutual exclusivity. This is exactly

what 3-year-olds did. However, if instead of a new label the experimenter gave children a random fact about one of the objects (for example, "that thing was given to me by my grandfather") and then the puppet asked the child to give her one of the objects using another random fact, children were choosing objects randomly. In that case they weren't relating an object with a fact and they didn't expect a person not present in the situation before to know that fact.

Although preschool children already have a good grasp of the conventionality principle and understand that it may not be applied to all situations and different kinds of non-linguistic information using this principle in word learning situations may be cognitively demanding as it requires tracking other people's experiences and thinking about what each person knows vs. does not know. Such cognitive load can be especially obvious in conversations with multiple people. One of the strategies that a child can use in multi-party conversations is to decide to whom a message (and a new word) is addressed. The ability to do so may simplify word learning situations by making the learning selective and by reducing the amount of perceived words.

In the current research we investigate children's ability to infer the intended addressee of a verbal message and their ability to use this information to narrow down the number of possibilities in word learning situations. We rely on previous findings that children can track people's experiences with objects, know what's new and what's old for other people and use this information to interpret ambiguous verbal messages (Akhtar, Carpenter, & Tomasello, 1996; Moll, Carpenter, & Tomasello, 2014; O'Neill, 1996; Tomasello, 2008).

We hypothesize that new information attracts the child's attention only if the communicative context does not change (for example, same group of people keeps playing the same game). If new information is given when the communicative context has changed (for example, a new person joins the game and does not know the rules of the game), such information shouldn't attract the child's attention. In such case this information should be perceived as addressed to other people and thus may be more difficult for the child to attend. In the current experiment we test children's ability to learn a new word from a natural conversation when the communicative context is kept constant and when it is altered by adding a new game partner. We predict that children will differentially interpret verbal messages containing a new word as addressed to them or to the new person, and this will affect their ability to remember the new word.

Experiment 1

Method

Participants. Fourty-three children (24 boys) between 2 years and 7 months and 3 years and 10 months (M = 3 years 6 months; SD = 0.7) were recruited from local day care centers and playgroups in a middle income neighborhood in Moscow. All subjects were typically developing with no speech, hearing or cognitive-emotional disorders. Children were tested in a quiet area in the day care center.

Parents provided informed consent for their children to participate.

Materials. For the purposes of the current task we built a small maze — a wooden platform with walls (50×30×7 cm). Thin wooden panels were placed inside the maze parallel to each other with gaps in different places. The maze itself was green, the panels inside were brown, and there were two yellow squares in the opposite corners on the maze. Six novel objects were used in the game (from 3 to 5 cm in length). They were of different shape, colour and material (a yellow button, a black metal ring, a green and orange earplugs, a red bead and a ceramic lid from a toy kettle).

A thin plastic stick (about 10 cm in length) was used to manipulate the target object. At the beginning of the game all six objects were placed by the walls of the maze in the sections divided by panels (see Figure 1). Children saw all 6 objects for the duration of the task. The experimenter sat across the table from the child and the assistant who sat next to the child.

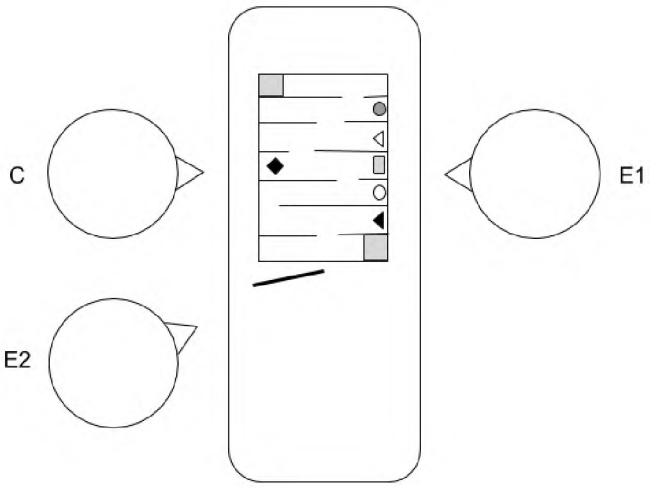
Procedure. The experimental procedure consisted of the play phase and the testing phase.

Play phase. At the beginning of the experiment children were given the following game instruction: "Imagine that this is a zoo. These are cages and paths <pointing at the sections>, and these are animals <pointing at the objects by the walls>. Help this animal <pointing at the target> get to its cage <pointing at the yellow square in the opposite corner>. This is a stick you should use in order to do this. You can't use your hands".

When the child was about half through the maze, the experimenter pretended that he should use a phone for a moment and asked him/her to stop and put the stick away. Then the

Figure 1

A schematic representation of the experimental set up (E1 – experimenter, E2 – assistant, C – child)



experimenter said the instruction again in the same manner but this time using a naming phrase with a novel word to refer to the target: "Imagine that this is a zoo. These are cages and paths, and these are animals. This is *bica/moza* (which novel word was used was counterbalanced across conditions and participants). This is a stick you can use to help *bica/moza* get to its cage. You can't touch *bica/moza* with your hands". The experimenter tried to create the impression that it was exactly the same instruction, and she was saying the new word several times intentionally.

All participants were randomly assigned to one of the two experimental conditions. In one condition that we will refer to as the «change» condition, the communicative context was altered before the second instruction was given. In this condition the child started the game only with the experimenter, and before the second instruction the assistant joined the game. The assistant was waiting behind the door and entered the room at a sign from the experimenter. In the other condition that we will refer to as the «no change» condition the assistant was sitting next to the child through the whole experiment, and therefore, there was no change to the communicative context. These conditions were aligned because children were distracted in the same degree by the experimenter's phone before the assistant joined and before the repeating of the instruction.

In the current experimental set up the second instruction should be interpreted differently by the child depending on the condition. In the change condition the second instruction should be understood as addressed to the assistant who was not familiar with the game. In this case the child's attention to the new information may be attenuated and the new word could easily be missed and not learned. In the no change condition the second instruction couldn't be interpreted as addressed to the assistant as she was present from the beginning of the game and was familiar with the initial instruction. In this case the child's attention should be attracted to the new information, and the second instruction should be interpreted as an important addition to the rules of the game. We predict that children in this condition should more easily pick the new word from the experimenter's message and learn it.

The second instruction was delivered in the exactly the same manner in both conditions. While saying the second instruction the experimenter was looking at the maze and did not maintain eye contact with the child or the assistant. Except for the greeting the assistant didn't say anything to either the child or the experimenter, didn't take part in the game, and watched it. Thus the two condition were identical in all respects except for the time when the assistant joined the game — at the beginning or before the second instruction.

Testing. The purpose of the test phase was to assess children's memory of the new word mentioned in the second instruction. The test phase occurred 10–15 minutes after the game was over. During the 10–15-minute break the child played a game not related to the experimental one with other children. The assistant was present during the test in both conditions and was sitting next to the child across the table from the experimenter.

In the test phase all six objects including the target were placed on the table. The experimenter asked the child to give him the *bica/moza*. The child's choice was categorized as either correct (the target object that the child moved across the maze) or incorrect (any other object). We predicted that children would perform better (would pick the target more often) in the no change than in the change condition.

Results and discussion

The purpose of this experiment was to investigate if children can differentially interpret verbal messages as addressed to them or not depending on the communicative context and if this affects children's ability to learn new words. We hypothesized that children would learn new words better if they assume that the message is addressed to them compared to a situation when they assume the message is intended for someone else. Our predictions were confirmed (see Table 1). Significantly more children picked the target object in the no change (80%) than in the change (10%) condition (test on small sample to independent proportions, $p < 0.0001$). Most children referred the new word to the target in the no change condition (80%) and didn't do so in the change condition (10%).

It's interesting to look at the incorrect choices children were making in change condition. Almost no one (4,3%) chose the object of the same shape as the target but of different colour (the earplug of different colour). Mostly (84%) they were choosing more salient objects — the button or the lid. If they chose the earplug it would mean that they do correlate some object's features such as shape with the word meaning, but not other less important features such as colour. Our results suggest that the change of communication context didn't allow children to establish the connection between the object and the word even partly and thus launch the mechanism of the formation of lexical meaning.

Overall, our results demonstrate children's sensitivity to the characteristics of communicative context in word learning. What are the mechanisms of this sensitivity and its further development? In addition to the main experiment we tested a small group of older children (8 children; M = 5.2 years) in the condition when the learning of the new word was more complicated, i.e. the second adult appeared in the middle of the task (change condition). Six out of 8 (or 75%) children remembered the new word correctly suggesting that children attended to this information in the conversation. Perhaps the sensitivity to communicative context stronger in the younger age then in the older. However, one may also suspect that 3–4-year-olds depend more on the constancy of the communicative context. They concentrate

Table 1

The comprehension test performance in two conditions in 3-year-olds

Conditions	Correct answers (%)	Incorrect answers (%)	Total
The change condition	2 (10)	18 (90)	20 (100)
The no change condition	16 (80)	4 (20)	20 (100)

more on the maze task than on anything else and any change may be disruptive for them. This hypothesis is in part confirmed by the fact that younger children spend more time on the task than older children – 7 minutes on average (M = 7.23 min; SD = 3.34), while children older than 4 years performed the task on average in 3 minutes (M = 3.58 min; SD = 1.12). Besides, younger children had difficulties following the instructions and frequently (85%) used their hands instead of a stick. The task may have been less effortful for older children and therefore they could dedicate more resources for learning new words. We test this idea in the next experiment. We made the task more difficult by giving 4-year-old children a stick that was difficult to manipulate the objects with. If 4-year-olds are still successful at the more complicated task in the change of communication context condition, then this ability requires not just attention resources free from the main task but has age-specific cognitive mechanism in its base, a mechanism responsible for picking out the new words from adult's speech.

Experiment 2

Method

Subjects. Twenty-two children between 3 years and 11 months and 4 years and 10 months (M = 4.2, SD = 0.7) participated.

Materials. We used the same materials (the maze and the objects) for this experiment but changed the stick used to move the target object along the maze. This time it was made of soft thin plastic, about 25 cm in length with a paper disc near the lower end that occluded it from the child's sight. This change increases the difficulty of the sensory-motor component of the game – the target object is now difficult to manipulate.

Design and procedure. Children were randomly assigned to the change and the no change conditions (11 in each). The procedure in both conditions was exactly the same as in the first experiment.

Results and discussion.

For the purposes of the manipulation check we compared the time children took to complete the task in the pilot study (see above) and Experiment 2. Children took significantly more time to finish the game with the inconvenient stick (M = 6.48 min; SD = 3.14). Despite that, children performed very well on the word learning task (see Table 2)

Children in both conditions picked the target object more often than is predicted by chance (binomial tests, $p < 0.001$). Additionally, there was no difference in children's identification of the target across conditions: 65% correct in the no change condition and 75% correct in the change condition (exact test on 2 independent proportions, $p = 0.52$).

These findings suggest that the difference in learning new words in two conditions in 3-year-olds (Experiment 1) likely cannot explained by attentional load and rather has an age-specific underlying mechanism that supports picking out and learning new words from the adult's speech in its base.

General discussion

Four-year-old children learned new words in the change of communicative

Table 2

Performance of the comprehension test in both conditions in 4-year-olds

Conditions	Correct answers (%)	Incorrect answers (%)	Total
The change condition	8 (75)	3 (25)	11 (100)
The no change condition	7 (65)	4 (35)	11 (100)

context condition unlike 3-year-olds who could learn new words only when the communication context did not change. It seems that children after 4 years of age are not affected by changes in addresses of verbal messages and can still single out a new word and remember it even when the message is not addressed to them. However before 4 years characteristics of the communicative contexts allow them to decide if a new word is worth of their attention or if it is addressed to someone else. Surprisingly, some studies show that 2-3-year-olds can acquire novel words from overheard speech, and they can learn also with a speaker who was present on video (Akhtar, Jipson, & Callanan, 2001; O'Doherty et al., 2011).

The novelty of our research lies in the fact that the object named by the adult didn't differ in its familiarity to another adult. Such method is quite common in research dedicated to the role of shared knowledge (Akhtar et al., 1996; Diesendruck & Markson, 2001). Shared/non shared knowledge in such research has to do with the difference in the amount of the information perceived by the child and the adult. In our research we relied on perceptual information to a smaller extent. By varying the communicative context, we induced different interpretations of the same pragmatic information in children. When the child thought that the information was addressed to him/her, it was interpreted as a signal to pay attention. However when the child thought that the information was addressed to another adult it was perceived as the background, irrelevant information. The fact that 3-year-olds' performance in the word learning task differed due to this interpretation suggests that children rely not only on perceptual information (available since 2 years old) but also on pragmatic characteristics of verbal messages.

It is possible that such learning differences are explained not only by the development of the child's cognitive and attentional abilities but also by the change in the social situation of his development. For example, it is known that after 2 years parents start using several names for the same object ("Look, it's a car. It's a truck") whereas before that age they avoid it (Callanan & Sabbagh, 2004; Mervis & Mervis, 1982). Furthermore, there is direct correlation between the frequency of parents' use of double names and the child's ability to remember the meanings of new words. Thus, parents use simpler naming strategies – to ease the learning – on early stages of lexical development and more complex strategies – to challenge the learning – on later stages. The situation may be similar when children rely on the communicative context to define the addressee of the new word. When talking to 3-year-olds, parents more often turn their attention

to other adults and then back to the child, thus, moving away from the strategy of motherese addressed strictly to the child. Consequently, as the amount of words in adults' speech addressed to the child increases it is important for children to be able to exclude words not addressed to them to simplify the learning. Future research may investigate if any features of parental behavior provide cues for children to do so.

Why could 4-year-olds remember new words even when the communicative context was changed? If they don't use changes to the communicative context as a cue that the message is not addressed to them then the learning situation must be more complicated for them than for younger children as they have to attend to all words, not only those addressed to them directly. On the other side, determining the addressee of the message is based on the interpretation of the second instruction. Children after 4–5 years might pay more attention to the adult's instruction. For example, they know that the instruction can be addressed to a group of listeners, not just one. Such changes can be related to the change in the social context of development, for example, to more frequent involvement of children in group activities after 4 years of age. The fact that the instruction is repeated doesn't mean the child shouldn't listen to it. This will require additional clues such as understanding that two adults are united by the common activity.

Overall our study demonstrates that 3-year-olds could learn new words only when the communicative context was constant, but 4-year-olds could learn new words in change and no change conditions.

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Чувствительность к коммуникативному контексту у детей 3 и 4 лет при усвоении ими значений новых слов

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Резюме

В исследовании проверялась гипотеза о том, используют ли дети 3 и 4 лет информацию о социальном контексте, создаваемом взрослым, для научения значениям новых слов. В жизни ребенка распространены ситуации, где присутствуют другие потенциальные адресаты сообщения, и ему необходимо правильно оценивать, кому именно адресовано новое слово. Такая способность позволяет существенно упростить ситуацию научения новым словам – сделать научение избирательным, снизить уровень сложности посредством ограничения количества воспринимаемых слов. Мы предполагали, что при появлении новой информации внимание ребенка привлекается к ней лишь в случае, если сохраняется коммуникативный контекст (например, при сохранении сюжета игры и присутствии только тех людей, которые были при ее создании). Если же новая информация появляется при изменении коммуникативного контекста (например, при появлении во время игры нового участника, который не присутствовал при обсуждении правил игры и потому не может знать о ее особенностях), то такая информация не должна привлекать внимание ребенка. В эксперименте детям произносили новое слово в одном из двух условий: при сохранении общего со взрослым коммуникативного контекста и при его изменении – появлении в ситуации нового взрослого. В результаты мы обнаружили, что усвоение нового слова у детей 3 лет происходило только в условиях сохранения коммуникативного контекста, а у детей 4 лет новое слово усваивалось в любом условии. Дополнительное исследование показало, что разница между детьми 3 и 4 лет в усвоении значений новых слов не зависит от уровня сложности выполняемой ими задачи.

Ключевые слова: развитие речи, усвоение новых слов, социальные подсказки, коммуникативный контекст, память.

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