



Insights from novel word learning: Error analysis and its relevance in understanding fast versus slow mapping

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Abstract

Novel word learning refers to the process of learning words. The words are assumed to be acquainted even after a short exposure and this phenomenon is termed as fast mapping. Some proponents believe that the new word learnt as a consequence of new word learning is momentous and the word may not be transferred to the lexicon if the word is not rehearsed and this strategy involving conscious learning is termed as slow mapping. The present study was carried out with the aim of carrying out of error analysis on data involving fast and slow mapping. 20 participants were divided into two sub groups of 10 each. The first method was exposed to lexical method of teaching while the second group was exposed to slow mapping. Participants performed well with slow mapping but the errors were more with this method compared to fast mapping.

Keywords: Slow mapping, fast mapping, vocabulary, mechanism of learning, transfer

1. Introduction

Novel word learning depends on two mechanisms known as fast mapping and slow mapping. Children often make correct guesses about the meaning of novel words. This is true not only with respect to the context of that speaker but also any or all the other instances including various categories. Understanding children's ability to learn novel words has been the theoretical and empirical concern of research in linguistics and developmental psychology. Hence many researchers have been studying the process of novel word learning in children experimentally. The findings from the experiment show that the children are able to acquire new words by the age of 3 and they make appropriate use of information from various sources to determine what the speaker is referring to at that instance and evaluate how those novel words could be used in different other future situations. A mere exposure to novel words will evoke learning and this process is termed as 'fast mapping.' This term 'fast mapping' was introduced by Carey & Barlett (1978.) This concept eventually became central to developmental psychology's narrative about the process of novel word learning. Fast mapping refers to the mechanism by which a new word or a concept is learned based on the presentation of information just once. It is thought to be a crucial component of language development by some researchers and it

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serves to some extent, to explain the rapid acquisition of vocabulary during the first two years of life. Researchers have found children's abilities to recall and sustain certain information, like, facts, but their ability to extend the same in novel words looks to be unique (Casenhiser & Goldberg, 2005). This indicates that fast mapping is a clearly defined mechanism for novel word learning.

However, research findings from the recent past are contradicting to the previous findings. It indicates that children do not learn novel words using 'fast mapping' but rather learn by associating predictive or probabilistic relationships between objects/actions and words which develop over time. Evidence for this comes from children's struggle to understand colour words. By the age of 4 years, children learn to distinguish between basic colour categories (Bornstein, Kesse & Weiskopf, 1976.) But, most of the sighted children use the colour words in the same way that blind children do (*Swingley, 1980*) Usually, colour words like "blue" and "yellow" will be present in their lexicon and they use them appropriately in their speeches, but their application of individual colour words is interchangeable and haphazard. If they are given a green cap and asked its colour, typical three-year-olds are likely to answer "green" as "yellow." These difficulties persist up until around age 4, even after hundreds of explicit training trials (Rice, Buhr & Nemath, 1990.) This inability of children to understand colour words can be explained by the cognitive process of whole object constraint. It is an idea that the child will understand that a novel word represents the entirety of that object. When an adult labels an object, the child assumes that it refers to the entire object and not any part or characteristic of that object. However, colour is the last attribute to be considered because it explains the least about the object itself. Children's behaviour clearly suggests that they have knowledge of these words, but this knowledge is far from complete, rather it appears to be predictive, as opposed to all-or-none. This mechanism of word learning is known as "slow mapping." Recent studies indicate that an increase in the prominence of cues enhances slow mapping and extension (Vlach, & Sandhofer, 2012)

The investigators opined that, although children learn novel words with a single exposure using fast mapping skills, it may not be sufficient for the development of the lexicon. To retain the words learnt through fast mapping, a subsequent extended slow mapping would be required for novel word learning. Slow mapping is mediated through semantic associations, hence teaching semantic associations would be necessary for slow mapping to operate. It is also important to know which mechanism (fast mapping or slow mapping) enhances novel word learning process in children because this is the age at which the child's vocabulary get boosted up.

Hence the present study is aimed at exploring the lexical semantic organization in children. It is also important to know which mechanism (fast mapping or slow mapping) enhances novel word learning process in children because this is the age at which the child's vocabulary get boosted up.

1.2 Aim of the study

The present study aims at qualitative error analysis of novel words learnt through fast mapping and slow mapping methods in young neuro-



typical children between the ages of five and six years.

1.3 Objectives of the study

To conduct qualitative error analysis of responses produced by children employing fast mapping (Lexical method) and slow mapping (Semantic method) methods of learning.

2. Methodology

The current study was an attempt in understanding and comparing the errors obtained through lexical and semantic methods of novel word learning in Kannada speaking children. The experiment was conducted in 3 phases; stimulus selection phase, training phase and testing phase. Further, the testing phase was divided into immediate recalling testing phase and delayed recalling testing phase.

2.1 Participants

The study involved a total of 20 participants. Equal number of males and females in the age range of 5 to 6 years were considered for the study. Individuals with normal dexterity and normal/corrected vision were included; participants with the history of any communication, psychological and other sensory impairments were excluded from the study. Informed consent was taken by the teachers and parents before enrolling the participants for the study.

Table 1
Participant details

Serial number	Age	Gender	Grade
1	5.11 years	Female	LKG
2	5.3 years	Female	LKG
3	5.3 years	Female	UKG
4	5.6 years	Female	UKG
5	5.2 years	Female	UKG
6	5.10 years	Female	UKG
7	5.4 years	Female	UKG
8	5.6 years	Female	UKG
9	5.5 years	Female	UKG
10	5.6years	Female	UKG
11	5.2 years	Male	UKG
12	5.2 years	Male	UKG
13	5.10 years	Male	LKG
14	5.3 years	Male	LKG
15	5.8years	Male	LKG
16	5.6 years	Male	LKG
17	5.11 years	Male	UKG
18	5.7 years	Male	UKG
19	5.2 years	Male	UKG
20	5.6 years	Male	UKG

2.2 Data collection and processing

A total of 40 meaningful words were shortlisted from an earlier study on fast mapping by Deepak & Shyamala, 2014. These words were checked for equal word length, phonological complexity and cultural aspects. These words were not familiar to the children in the aforementioned age range and were taken from text books of higher classes like 3rd and 4th grade. They were presented in the visual mode in the form of coloured pictures as well as in the auditory mode using the presentation software- Powtoon. (Powtoon is freely available online software which helps in creating animated presentations). Using this software, the picture of the stimulus and the recorded audio clip of the stimulus can be presented simultaneously. There is provision for online audio recording as well. The duration of presentation of each stimulus can be specified. The software is user friendly and easy to access.

Word Selection: Novel words are the unfamiliar words to all the participants. They are usually assumed to be acquired beyond the stipulated age (6 years in the present study.) In order to ensure that the words are unfamiliar, they were subjected to testing. All the 20 participants of the study were asked to name the pictures presented using the software-powtoon. The words that were not named by 90% of the participants were considered as the 'novel words' and subsequently used in the training phase. No feedback was given to the participants.

Training phase: In this phase, the participants were divided into two groups on the random basis. One group was trained using the fast mapping (lexical method) and the other group was trained using slow mapping (semantic method) for novel word learning.

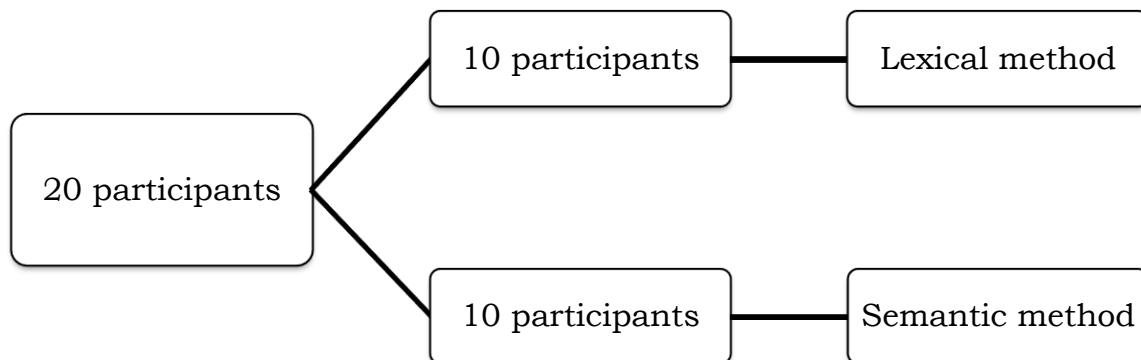


Figure 1. Depiction of the grouping of participants

Presentation for the lexical method; in the lexical method of training, each novel word was presented 5 times in visual and auditory mode in a laptop using Powtoon software. A vigilant stimulus “++++” appeared on the screen followed by the picture of the novel word, synchronized with the audio clip of the novel word. No prompts were given during this training period. The stimulus presentation was set to 3 seconds and an inter-stimulus interval was set to 2 seconds.



Figure 2a. Example of stimulus presented in the lexical method through visual mode.

Presentation of the recorded auditory stimulus- /ni:ra:nE/ (5 times)

Presentation for the semantic method

In the semantic method of training, each novel word was presented along with the semantic cues. A vigilant stimulus “++++” appeared on the screen followed by the picture of the novel word, synchronized with the audio clips of the semantic cues for the novel word. The semantic cues were the name of the lexical category, a category coordinate belonging to the same lexical category and a feature associated with the target. The stimulus presentation was set to 10 seconds and inter-stimulus interval was set to 2 seconds. The training for participants for the participants trained under lexical and semantic methods was carried in a single session



Figure 2b. Example of stimulus presented in the semantic method through visual mode.

Presentation of the recorded auditory stimulus- /IqU ni:ra:nE/
/Iq̣u oṇu pra:ŋI/
/Iq̣u ni:rInallI va:sIsutṭaḡE/

Phase 2: Testing phase

This phase was common to the lexical and semantic method. Here, immediate and delayed recall of the learnt words was checked. Immediate recall testing was carried out immediately after 5 minutes of training, while delayed recall testing was carried out after a time gap of 5 days. The responses were evaluated for both immediate and delayed recall based on

the naming task. No feedback was provided during the testing phase as it may have impeded the further responses produced by children.

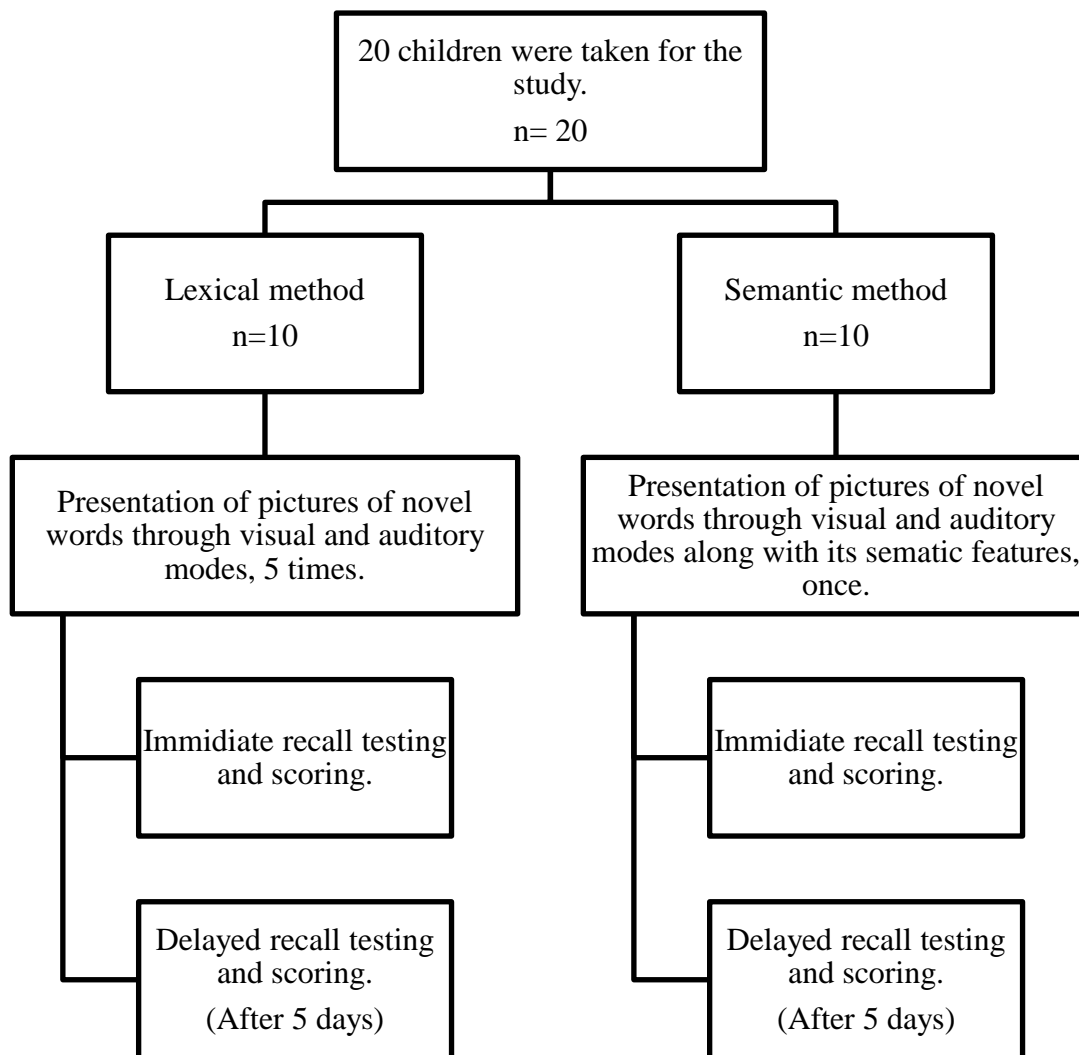


Figure 3. Schematic representation of the method

2.3 Analysis

In the naming task, the child was asked to name the picture of the novel word shown on the laptop. A score of ‘1’ was given for the correct response. To rule out the effect of the order of stimulus on the responses, the counterbalancing of the task was done, where the order of presentation of the stimulus was changed for every child. The qualitative error analysis was carried out where the errors were grouped into four categories, which are, Semantic errors, phonemic errors, responses from the other language and No response. Descriptive analysis was carried out to analyses the error types.



3. Findings

The aim of the study was to conduct qualitative error analysis in novel word learning in young neuro-typical children. The experiment included training phase and testing phase. In the training phase, the participants were divided into 2 groups. One group received training through lexical method while the other group received training through the semantic method. This was followed by testing phase, which was common to both the groups. The testing phase was divided into immediate recall testing and delayed recall testing. Immediate recall testing was done immediately after training and the delayed recall testing was done after 5 days of training. The first objective was to conduct qualitative error analysis of responses produced by children employing the lexical method and semantic method of learning. The qualitative analysis was carried out to investigate the lexical semantic organization in children. The responses obtained by children during the testing phase (both immediate and recall testing) were subjected to qualitative analysis. The incorrect responses were classified as ‘semantically related response or semantic errors’ (when it belongs to the same lexical category as the target word ex goat for sheep), ‘phonemic errors’ (based on the relationship shared with the target word ex doll for dog), and ‘responses produced in the other language’ (any response produced in a language other than the language tested ex /nayi/ for /dog/). The individual percentage values of the qualitative error analysis of responses obtained by children employing lexical and semantic methods (in both immediate and delayed recall levels) are tabulated in the table 5 and table 6 respectively.

Table 2
Group mean values (in percentage) of qualitative error analysis of responses obtained by children in Lexical method of training in both immediate and delayed recall levels

	Correct responses	Incorrect responses			
		Semantic errors	Phonemic responses	Response from other language	No response
Immediate	13.5	3%	3%	7%	73.5%
Delayed	5.5%	1.5%	2%	6%	85%

Table 3

Group mean values (in percentage) of qualitative error analysis of responses obtained by children in Semantic method of training in both immediate and delayed recall levels

	Correct responses	Incorrect responses			
		Semantic errors	Phonemic responses	Response from other language	No response
Immediate	25.5%	9%	3%	7%	55.5%
Delayed	18.5%	8%	2%	5.5%	66%

The percentage of semantic errors (where semantically related words were used in place of target word) were more in semantic method compared to lexical method while the percentage of phonemic errors were observed to be same across both the methods. The responses from another language (English, in all the cases) were also same across both the methods. These overall responses were also observed to be more at immediate recall level compared to the delayed recall level, in both the groups.

4. Discussion

The present study aimed at conducting error analysis of responses obtained by young neuro-typical children who learnt novel words employing fast mapping and slow mapping methods. It attempted to examine fast mapping skills through lexical method of training and slow mapping skills through semantic method of training. The experiment included training phase and testing phase. In the training phase, one group of participants received training through lexical method while the other group received training through the semantic method. This was followed by testing phase, which was common to both the groups. It employed naming task. It was further divided into immediate recall testing and delayed recall testing. Immediate recall testing was done immediately after training and the delayed recall testing was done after 5 days of training. The responses obtained from the participants were subjected to qualitative error analysis.

The objective of the study was to conduct a qualitative error analysis of the responses obtained from the participants. The incorrect responses were classified into 4 groups. They were, semantically related response or semantic errors (when it belongs to the same lexical category as the target word), phonemic errors (based on the relationship shared with the target word), responses produced in the other language (any response produced in a language other than the language tested) and 'no response.' The individual scores were tabulated and analysed.



It was observed that the semantic errors were more in semantic method compared to the lexical method. This could be because of confusion or incorrect representation of the word in the lexicon as the method of learning involved teaching the novel word in a meaningful context associating it with its features. Exposure to more number of words would have resulted in such errors indicating confusion with respect to the word retrieval. The phonemic errors and responses from the other language were observed to be same across both the groups (lexical and semantic).

The responses were also observed to be more at immediate recall level compared to the delayed recall level, in both the groups, again indicating the role of short term memory. Delayed recall is triggered by the active function of long term memory which depends on frequency of rehearsals and exposure to the word and its associations. Whereas, immediate recall is triggered by the short term memory which is independent of rehearsals. Therefore, to make the older memory stronger, sufficient exposure in the meaningful context and rehearsals are required. This explains why the performances of children are better on immediate recall compared to delayed recall level.

5. Conclusion

The current study was an attempt in understanding and comparing the errors obtained through fast mapping and slow mapping methods of novel word learning in Kannada speaking children. It aimed at examining fast mapping skills through lexical method of training and slow mapping skills through semantic method of training. The objectives of the study was to conduct qualitative error analysis of responses produced by children employing the lexical method and semantic method of learning at both immediate and delayed recall levels.

The study involved a total of 20 participants. Equal number of males and females in the age range of 5 to 6 years were considered. The experiment was conducted in 3 phases; stimulus selection phase, training phase and testing phase. In stimulus selection phase, a total of 40 meaningful words were shortlisted from an earlier dissertation on fast mapping by Deepak & Shyamala, 2016. They were presented in the visual mode in the form of coloured pictures as well as in the auditory mode using the presentation software- Pawtoon. The words that were not named by 90% of the participants were considered as the 'novel words' and subsequently used in the training phase. No feedback was given to the participants. In the training phase, the participants were divided into two groups on the random basis. One group was trained using the lexical method and the other group was trained using semantic method for novel word learning. This was followed by testing phase, which was common to both the groups. Here, immediate and delayed recall of the learnt words was checked. Immediate recall testing was carried out immediately after 5 minutes of training while delayed recall testing was carried out after a time gap of 5 days. The responses were evaluated for both immediate and delayed recall based on the naming task. A score of '1' was given for every correct response and a score of '0' was given for every incorrect response. Further, the errors were classified into 'semantically related response or semantic errors' (when it belongs to the

same lexical category as the target word), 'phonemic errors' (based on the relationship shared with the target word), 'responses produced in the other language' (any response produced in a language other than the language tested) and 'No response' (when the child did not give any response.)

The observations indicate that the semantic errors or semantically related words were more in semantic method compared to the lexical method. This could be because of exposure to more number of words resulting in confusion with respect to the word retrieval. The phonemic errors and responses from the other language were observed to be same across both the groups (lexical and semantic). The responses were also observed to be more at immediate recall level compared to the delayed recall level, in both the groups, again indicating the role of short term memory (Gershkoff-Stowe, & Hahn, 2007). Thus, based on the overall findings, it can be concluded that the method of training plays an important role in novel word learning. Semantic method of training which is based on the concept of slow mapping enables retaining the words better but creates confusion resulting in more number of semantic errors. However it is noteworthy to mention that the sample size considered for the study was limited and the sample size is to be increased for future studies to increase the generality of findings.

References

- Bornstein, M. H., Kessen, W., & Weiskopf, S. (1976). Color vision and hue categorization in young human infants. *Journal of Experimental Psychology: Human Perception and Performance*, 2(1), 115.
- Carey, S. (2010). Beyond fast mapping. *Language Learning and Development*, 6(3), 184-205.
- Casenhiser, D., & Goldberg, A. E. (2005). Fast mapping between a phrasal form and meaning. *Developmental science*, 8(6), 500-508.
- Deepak, P & Shyamala, K. C., 2015. *Fast mapping abilities in young bilingual children*, unpublished master's dissertation, submitted to the University of Mysore.
- Gershkoff-Stowe, L., & Hahn, E. R. (2007). Fast mapping skills in the developing lexicon. *Journal of Speech, Language, and Hearing Research*, 50(3), 682-697.
- Rice, M. L., Buhr, J. C., & Nemeth, M. (1990). Fast mapping word-learning abilities of language-delayed preschoolers. *Journal of Speech and Hearing Disorders*, 55(1), 33-42.
- Swingle, D. (2010). Fast mapping and slow mapping in children's word learning. *Language learning and Development*, 6(3), 179-183.
- Vlach, H., & Sandhofer, C. M. (2012). Fast mapping across time: Memory processes support children's retention of learned words. *Frontiers in psychology*, 3, 46.