INTERNATIONAL JOURNAL OF MIND, BRAIN & COGNITION
VOL. 1, NO. 1, JAN-JUN 2010

Fast Mapping of Novel Words: A Cross-Linguistic Study

K. K. VISHNU
All India Institute of Speech and Hearing, Mysore

ARYA ABRAHAM
Father Muller Medical College, Mangalore

SAPNA BHAT
Southern Denmark University, Denmark

SHYAMALA. K. CHENGAPPA
All India Institute of Speech and Hearing, Mysore

ABSTRACT

Lederberg et al. (2000, cited in Morais & d'Ydewalle 2006) *described fast mapping as a form of rapid word learning in which the individual is given explicit references for the new words. The present study investigated fast mapping skills in Kannada-English bilinguals and Tulu-Kannada-English multilinguals. 40 bilingual/multilinguals whose age ranged from 18 to 25 were selected as participants. Each participant was assessed for the acquisition of novel words in each language, using referent identification and picture naming tasks. Results obtained showed no significant difference between L1 and L2 for Kannada – English bilinguals. But the Tulu-Kannada-English trilinguals showed a different pattern. Prior language proficiency, exposure and spoken usage appear to jointly determine the patterns observed.*

INTRODUCTION

Given that half of the world's population has some elementary knowledge of a second language, and that more people understand English as a second language (L2) than as a first language (L1), one would expect bilingualism to be a core issue in psycholinguistic research. A multilingual person, on the broadest definition, is a person

able to communicate in more than one language, actively (at the level of speaking and writing) or only passively (at the level of listening and reading). In this study, we take bilinguals and multilinguals to be adults who learn a majority language from birth (L1) and use it as a mother tongue for primary functions in their society, and who begin to learn a second language (L2) – and, in the multilingual case, a third language (L3) – from early childhood and use L2 (and, where applicable, L3) for formal functions in their society. This definition is closely related to criteria used by Jia, Kohnert & Collado (2006) to define multilinguals in their study on Spanish-English-Dutch trilinguals.

Fast mapping (Carrey & Barret 1978) is a hypothesized process enabling individual to create lexical representations for the unfamiliar words which they encounter. Developing further the tasks to be used for the study of such processes, Lederberg et al. (2000, cited in Morais & d'Ydewalle 2006) described fast mapping as a form of rapid word learning in which the individual is given an explicit reference for each new word. Learning new linguistic forms in a multilingual environment is a challenging task, and its analysis can in principle improve our understanding of how lexical representations are created and stored. Vocabulary is a cross-linguistically variable domain, and the availability of vocabulary in the case of an individual speaker depends – in ways that are amenable to investigation – upon his/her experience and exposure to the language/s, his/her education, socio-economic status, native language/dialect, IQ and sex (Mallikarjun 2002).

The list of factors provided by Mallikarjun does not include age as a crucial variable. There is some evidence that the age at which a learner is first exposed to L2 learning may be correlated with overall vocabulary acquisition (Eisenstein 1990, cited in Morais & d'Ydewalle 2006). While the claim that age influences learning strategies seems consistent with a wide range of studies, the details of this effect are far from clear. Bronson (2000, cited in Morais & d'Ydewalle 2006), reviews a body of literature suggesting that, as the ability for strategy use develops, the subjects' approach to L2 vocabulary learning may also evolve. Other studies have supported the idea that new vocabulary learning is more lexically mediated during the earlier stages of learning than in later stages. Kroll & Stewart (1994) found written translations to be faster than L2 picture-naming in early L2 learners, but the naming and translation speeds did not differ for more proficient learners. Kroll & de Groot (1997) found that less proficient Spanish speakers spent more time in making judgments when words were lexically similar, while the more proficient speakers met more interference when judging

semantically similar words. This result provides further evidence for the use of lexical mediation in the earlier stages of language learning.

Learning to add vocabulary from a new language to an already existing language at a younger age, at which the use of a direct mapping approach is natural, involves little or no use of translation into L1. In contrast, learning a new language at a later age, once lexical mediation has established itself as a strategy, results in greater use of translation into L1 (Dijkstra 2006, cited in Morais & d'Ydewalle 2006). It was hypothesized that early L2 learners may map a novel word relatively quickly, which leads us to predict faster recall of novel words. The preference for such a vocabulary learning strategy would then lead to greater lexical proficiency. This view stresses the possibility that learning an L2 in one's early childhood and learning it later in life may tend to be associated with different learning strategies. The suggestion is that young children, when learning a new L2 word, may simply connect the new word to a perceptual representation of the referent.

However, the evidence does not point unambiguously towards a simple correlation between age and distinct learning styles; proficiency seems to be a distinct factor. Potter et al. (1984, cited in Morais & d'Ydewalle 2006) present data suggesting that conceptual representations mediate L2 vocabulary learning at both early and late stages of language learning. In their study, the reaction time data for proficient learners performing naming tasks with new vocabulary items suggested that they make optimal use of a conceptually mediated approach to new language vocabulary processing, and that the successful use of this approach may eliminate the effect of age.

Chen & Leung (1989) evaluated the role of L1 lexical mediation and concept mediation in the learning of new vocabulary. They found that children used more concept mediation than older L2 learners. They took the view that an individual whose trajectory includes the early learning of L2 vocabulary and an individual who develops a richer monolingual repertoire in the L1 first end up with very different learning strategies as a consequence of these personal histories. The crucial difference might be that L1 learning involves connecting labels to otherwise unnamed entities, while L2 learning involves learning new labels for entities for which L1 names have already been learnt.

Kan & Kohnert (2008) first investigated the ability of young monolingual children to fast-map new word forms, and concluded that there was a strong association with age and existing vocabulary knowledge. But a later study on bilingual Hmong-English speaking children by the same authors concluded that the fast mapping performance was not related to age or existing vocabulary knowledge.

These results suggest that bilinguals and monolinguals, having as they do different learning histories, respond differently to novel word learning tasks.

Research directly addressing that issue provides evidence that bilingualism itself may be a factor in an individual's ability to learn new vocabulary items. In particular, Eisenstein (1990, cited in Morais & d'Ydewalle 2006) argued that bilingualism was positively correlated with overall language learning aptitude.

The studies cited above, although they do not converge on an unambiguous account of the factors that determine the choice of strategy in novel word learning tasks, at least help identify directions for further inquiry in the case of monolinguals and bilinguals. It is not easy, however, to use these results in order to arrive at norms (for clinical or other use) applicable to Indian speech communities, where bi- or multilingualism is quite frequent. A literature search shows that nothing is known about the way age, language learning history and other factors interact in the responses of subjects from Indian speech communities to novel word learning tasks.

It is thus appropriate to perform at least preliminary analyses of novel word learning data from a speech community in which it is possible to compare bilingual with trilingual subjects; hence the present study.

In the Southern Karnataka region, where this study was conducted, the most widely used languages are Tulu, Kannada and English. Kannada, with a national total of 40 million speakers, is the dominant language of the state of Karnataka. Tulu, with 1.5 million speakers, though not a dominant language, is a robust feature of the linguistic landscape of Southern Karnataka. Its speakers use Tulu with relatives and friends, Kannada as a spoken language in institutional settings, and English to meet certain formal and educational needs. Native speakers of Kannada speak Kannada in most domains, confining the use of English to certain formal and educational functions. Thus, it is relatively easy to find Tulu-Kannada-English trilingual subjects and Kannada-English bilingual subjects who differ only in their language learning histories and are otherwise comparable.

NEED FOR THE STUDY

While the literature provides some findings that pertain to fast mapping in the context of monolingual and bilingual subjects, comparable fast mapping studies involving bilinguals and trilinguals are unavailable. In the Indian context, for clinical, pedagogic and other purposes, it is

necessary to establish norms covering trilinguals as well. The absence of empirical material comparing bi- and trilinguals becomes a major problem. India is a country where ordinary adults, in their everyday life, are often exposed to novel words in languages in which they have relatively low proficiency. It is thus imperative to attain some understanding of the strategies that come into play when they counter these new words. This study is a first step towards such understanding.

AIM

The aim of the present study was to investigate fast mapping skills in subjects who speak either (1) or (2):

(1) Kannada (L1) and English (L2)
(2) Tulu (L1), Kannada (L2) and English (L3)

METHODOLOGY

Participants

40 bilinguals/multilinguals whose age ranged from 18 to 25 were selected as participants. Group A consisted of 20 bilinguals whose mother tongue was Kannada and whose second language was English. Group B consisted of 20 multilinguals who spoke Tulu as L1, Kannada as L2 and English as L3. It is to be noted that subjects in group B had had considerable exposure to English and spoke English fluently. These subjects were matched on their linguistic proficiency across languages; the Language Experience and Proficiency Questionnaire (LEAP-Q) (Marian, Blumenfeld & Kaushanskaya 2007) was used for this purpose. None of the subjects exhibited any history of auditory disorders, hearing loss, speech/language problems, neurological deficits or any other sensory, motor or cognitive problems.

Stimuli

The stimuli consisted of 24 novel words, 8 words in each language. A stimuli pool was created with sound combinations in Kannada, Tulu and English that counted as possible words in conformity with the phonological composition of these languages; care was taken to ensure that it was possible to pronounce the stimuli naturally. The novel words used in the current study were selected from this stimulus pool after being validated with the help of two linguists. 8 novel words in each language were grouped into 4 pairs; 24 pictures that the participants were unlikely to be familiar with were selected. Each of these pictures

was connected to one novel word. A total of 12 short stories were devised, 4 stories in each language. Each pair of words was embedded in the story in such a way that no two novel words would occur within a single sentence.

To take a few examples, the English novel word *Penears* was associated with a picture of a synagogue – an image that the participants were unlikely to be familiar with. The novel words *Hugura* (Kannada) and *Jeppula* (Tulu) were associated with pictures of an avalanche and a submarine respectively.

Procedure

The participants were taken to a room that was devoid of distractions and a word learning task was administered. The word learning task consisted of five sessions. In the initial phase these novel words were introduced by a live story narration along with a picture presentation. The novel words appeared in every narrative unit, maximizing the participants' exposure to these words. The stories were repeatedly presented in each language for the next four sessions. Each participant was assessed for the acquisition of these novel words following the five phases of story narration; the testing was segmented into two different tasks:

a. Referent identification
b. Picture naming

In the referent identification task, a set of three picture choices was provided. The picture choices included the target referent and two distractors: a semantically related referent and an unrelated referent. The target referent was then presented auditorily via a loudspeaker and the participant was instructed to point to the picture that corresponded to the auditory stimulus.

E.g. in English the *Penears* picture (a synagogue) was shown along with a mosque and a school. The notions of synagogue and mosque are semantically related (places of worship) while the school is an unrelated referent. A similar procedure was used for all novel words in the three languages.

In the picture naming task, the target referent was presented via a laptop computer and the participant was asked to name it. Responses were video-recorded and phonetically transcribed for later analysis.

ANALYSIS

The participant's responses – which had been video-recorded and phonetically transcribed – were analyzed as follows. Responses were evaluated for two different tasks:

a. Referent identification
b. Picture naming.

Reaction or latency time measurements were used to specify the responses for these tasks. Scoring for both the tasks was carried out on the basis of the percentage of words correctly identified and of words correctly named. The percentage of word repetition errors for the participants in both the groups was calculated using the following formula:

$$\frac{\text{Number of correctly repeated/ identified words}}{\text{Total number of words}} \times 100$$

Word error analysis was done using the Li & Williams (1990) checklist, an extended version of the error categorization system devised by Kohn & Goodglass (1985). Reaction times for naming and referent identification were calculated separately and the mean reaction time of each individual in all languages was calculated. In Group A the reaction time for the two languages was analyzed using the Paired T test; in Group B, one way ANOVA was used for reaction time calculations for the two tasks.

RESULTS

Group A (Kannada-English bilinguals)
Reaction time: The reaction time results obtained for Kannada-English bilinguals were examined in two conditions:

a. Comparison of reaction time between L1 and L2
b. Comparison of reaction time within L1 and L2

Table 1. *Comparison of reaction time between Kannada and English (Mean, standard deviation and t value)*

Task	Language	Mean	Sd	t value
Referent Identification	L1	2.2024	0	0 NS
	L2	2.2024		
Naming	L1	0.24	0.63	1.39NS
	L2	0.20	0.58	

(p<.05=* significant, p<.01=** highly significant, NS=Not significant)
Referent Identification and Naming tasks were evaluated in detail with respect to reaction time response in all languages. No significant differences were observed for the naming and referent identification tasks in L1 and L2. The duration for naming and identifying the new words were the same in L1 (Kannada) and L2 (English).

Table 2. *Comparison of reaction time within Kannada and English (Mean, standard deviation and t value)*

Language	Task	Mean	Sd	t value
L1	Referent Identification	2.2024	0.84	2.62*
	Naming	0.24	0.63	
L2	Referent Identification	2.2024	0.84	2.93*
	Naming	0.20	0.58	

Comparison of reaction time within L1 and L2 for referent identification and naming revealed a highly significant difference. Referent identification scores were observed to be better for all the participants when compared with the naming task.

Table 3. *Percentage of words correctly repeated and identified for L1 and L2*

Tasks	L1	L2
Referent Identification	100%	100%
Naming	82.5%	82.75%

The percentages of correctly identified words in the two languages were similar (100%). The percentage of correctly repeated words was slightly higher in L2 (82.75%) followed by L1 (82.5%).

Table 4. *Percentage of word repetition errors*

Word Errors	L1 (%)	L2 (%)
Syllabic repetition	3.75	1.25
Syllabic substitution	3.75	1.25

Addition	1.87	0.62
Related word error	__	2.5
Part word repetition	0.62	1.87
Rejection error	0.62	0.62
Reduplication	1.25	
Final consonant deletion	__	3.12
Phonemic omission	__	6.25

A detailed analysis of word errors was carried out and percentages of word error types in the two languages were computed. The types of error observed in L1 are syllabic repetition (3.75%), syllabic substitution (3.75%), addition (1.87%), part word repetition (.62%), rejection error (.62%) and reduplication (1.25%). Percentages of syllabic repetition and substitution were greater in L1; no final consonant deletion or phonemic omission errors were observed.

The error types in L2 include syllabic repetition (1.25%), syllabic substitution (1.25%), addition (.62%), part word repetition (1.87%), rejection (.62%), final consonant deletion (3.12) and phonemic omission (6.25%). Final consonant deletion and omission errors were more frequent in L2; no reduplication was observed.

Results of Group B (Tulu-Kannada-English multilinguals)

To find significant differences in naming and referent identification for L1 (Tulu), L2 (Kannada) and L3 (English), one way ANOVA was carried out.

Table 5. *Mean and standard deviation of the reaction time for naming task in L1, L2 and L3*

Languages	**N**	**Mean**	**SD**
L1	120	6.28	2.19
L2	120	6.82	1.88
L3	120	2.32	0.47

Mean reaction times for naming task in L1(Tulu) and L2 (Kannada) were almost similar, with a minimal difference in standard deviation. L3 (English) exhibited better naming scores, i.e. lower reaction times, when compared with L1 and L2.

Table 6. *Comparison of reaction time for Naming task in L1, L2 and L3 using ANOVA*

Sources of variation	Degree of freedom	Mean square	F_{cal}	Significant difference
Between group	2	724.236	252.035	.000
Within group	357	2.874		
Total	359			

Lower reaction times were obtained for L3, followed by L1 and L2. L3 (English) showed a highly significant difference with L1 (Tulu) and L2 (Kannada) in both the conditions (i.e. within and between groups).

Table 7. *Mean and standard deviation of reaction time for referent identification in L1, L2 and L3*

Languages	N	Mean	SD
L1	120	1.0417	0.2007
L2	120	1.0672	0.2515
L3	120	1.0000	0.000

From the above table it is clear that there was no marked difference in mean reaction time for the referent identification task in L1, L2 and L3. However, there was a minimal difference in the mean and standard deviation scores for L3 (English) when compared with L1 and L2. This indicates that L3 scores were slightly better, followed by L1 and L2.

Table 8. *Between and within group comparison of reaction time for referent identification in L1, L2 and L3*

Sources of variation	Degree of freedom	Mean square	F_{cal}	Significant difference
Between group	2	.138	4.000	.019
Within group	356	3.442E-02		

Comparison of reaction time between and within languages for referent identification revealed no significant differences between L1, L2 and L3.

Table 9. *Percentage scores of naming and referent identification*

Tasks	Tulu	Kannada	English
Referent identification	100%	100%	100%
Naming	77%	73%	88%

All the target referents were correctly identified by subjects in L1, L2 and L3. The maximum number of naming scores were obtained in L3 (88%), followed by L1 (77%) and L2 (73%).

Table 10. *Analysis of word errors in L1, L2 and L3*

Word Errors	L1 (%)	L2 (%)	L3 (%)
Syllabic repetition	4.75	3.75	1.55
Syllabic substitution	3.25	3.5	.82
Addition	1.55	1.85	.25
Related word error	__	__	2.5
Part word repetition	0.42	.25	1.87
Rejection error	1.25	2.25	0.62
Reduplication	.62	.425	__
Final consonant deletion	__	__	4.25
Phonemic omission	__	__	5.85

Word error analysis in the particular languages showed maximal percentages for syllabic repetition (4.75% and 3.75%), syllabic substitution (3.25% and 3.5%) and addition errors (1.55% and 1.85%) in Tulu and Kannada respectively. Part word repetition (.42% and .25%) and rejection errors (1.25% and 2.25%) also occurred in L1 and L2. However, errors such as final consonant deletion and phonemic omission were not observed in either Kannada or Tulu. In English, the highest percentages were observed in the case of omission errors (5.85%) and final consonant deletion errors (4.25%), followed by part word repetition (1.87%).

DISCUSSION

The goal of the present study was a comparison – for normative purposes, with clinical applications in mind – of fast mapping skills in Kannada-English bilinguals and Tulu-Kannada-English multilinguals. Naming and Referent Identification were used to probe the fast mapping skills in this population. Results obtained showed no marked difference between L1 and L2 for Kannada-English bilinguals. Naming scores for L1 and L2 were similar. This result supports the view that, as language proficiency increases, so does the strength of the connections between language word forms in the lexicon and the semantic system, with the consequence that it becomes easier to retrieve word meanings directly and quickly (Kroll & Stewart 1994; Kroll & de Groot 1997). Individuals were matched for language proficiency using the Language Experience and Proficiency Questionnaire (LEAP-Q). This may help explain the relatively limited range of variation in the learning of new vocabulary items in this population.

The Tulu-Kannada-English trilinguals showed a different pattern of results. Reaction time for naming in English was better, followed by

Tulu and Kannada. This effect may be due to the fact, noted earlier, that subjects in Group B had had considerable exposure to English and often used English for communication.

The referent identification scores across languages did not vary significantly across the two groups. Participants in both the groups received equal and repeated auditory presentation for all the novel words. Studies have suggested that repetition in a language comprehension training task would enable faster lexical access (Fukkink et al. 2005, cited in Morais & d'Ydewalle 2006). This may be the reason for similar identification scores across languages.

A detailed error analysis in all the languages revealed similar error patterns in Kannada and Tulu. Syllabic repetition, substitution and addition errors were found to have the highest scores in these languages. English exhibited a greater proportion of omission and final consonant deletion errors. This finding could be interpreted as a reflection of the major structural differences between English and the other languages. Correspondingly, the similar proportions of error types in Kannada and Tulu may be due to the close linguistic similarity between these languages. Phonemic deviation showed the highest score; such deviations occur more often in a second language. It is possible to suggest a weaker phonological mechanism in the subjects' knowledge of the second language. However, little is understood about error patterns during the learning of novel words in the case of Indian languages – or for any trilingual subjects – and it would be premature to do more than suggest the possibility that L2 phonological systems may in general be weaker than L1 systems.

CONCLUSION

The purpose of the current study was to compare the fast mapping skills in bilinguals and multilinguals in two different language scenarios. The results indicated that proficiency and degree of exposure contributed to fast mapping skills in a particular language. The effect was clearest in the reaction time scores for naming novel words in each language. The multilingual subjects in Group B, with a higher degree of exposure to English in their communicative environment, attained higher scores. The similar naming scores obtained for Kannada-English bilinguals could be interpreted as reflecting equal exposure to L1 and L2. The results obtained in the present study are consistent with the view that novel word learning is not an idiosyncratic reflection of a subject's personal linguistic history, but that generalizations are possible and

involve such factors as language proficiency, degree of exposure and opportunities for frequent conversational use. The results also show that language dominance is a distinct factor; even if two populations both have English in their repertory, it may be dominant in one population but not in the other, with sharply different consequences.

As we work towards clinically useful norms in the multilingual societies of India, it becomes necessary to improve our understanding of different linguistic repertories and the effects they have on a subject's word perception ability for each language in his or her repertory.

The present study has major implications for language impaired populations affected by hearing impairment, specific language impairment, and other difficulties that affect the learning of new words. Studies that seek to replicate these results for other multilingual groups in India are desirable. The results of such studies will be of great use in the context of setting treatment goals for language disabled individuals.

REFERENCES

Apel, K. & Kamhi, A. 1987. Fast mapping skills of language impaired children: A muke is a muke. Paper presented at the *Annual Convention of the American Speech-Language-Hearing Association*, New Orleans, L.A.

——. & Dollaghan, C. A. 1985. Fast mapping skills in young children: Name that word. Paper presented at the *Annual Convention of the American Speech-Language-Hearing Association*, Washington, D.C.

Carey, S. & Barlette, J. 1978. Acquiring a single new word. *Papers and Reports on Child Language Development*, 15, 17-29.

——. 1978. The child as word learner. In M. Halle, J. Bresnan & G. Miller (Eds), *Linguistic Theory and Psychological Reality* (pp. 264-93). Cambridge, MA: MIT Press.

Chen, H. & Leung, Y. 1989. Patterns of lexical processing in a non-native language. *Journal of Expermental Psychology: Learning, Memory and Cognition*, 15/2, 316-325.

Dijkstra, T. & Van Heuven, W. J. B. 2002. The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism: Language and Cognition*, 5, 175-197.

Heibeck, T. & Markman, E. 1987. Word learning in children: An examination of fast mapping. *Child Development*, 58, 1021-1034.

Jia, G., Kohnert, K. & Collado, J. 2006. Action naming in Spanish and English by sequential bilingual children and adolescence. *Journal of Speech Language and Hearing Research*, 49, 588-602.

Kan, P. & Kohnert, K. 2008. Fast mapping in bilingual preschool children. *Journal of Child Language*, 35, 495-514.

Kohn, S. E. & Goodglass, H. 1985. Picture-naming in aphasia. *Brain and Language*, 24, 266-283.

Kroll, J. F. & Stewart, E. 1994. Category interference in translation and picture naming - Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33, 149-174.

——. & de Groot, A. M. B. 1997. Lexical and conceptual memory in the bilinguals: Mapping form to meaning in two languages. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in Bilingualism: Psycholinguistic Perspectives* (pp. 201-24). Mahwah, NJ: Lawrence Erlbaum.

Li, C. T. & Williams, S. T. 1990. Repetition deficit in three aphasic syndromes. *Journal of communication disorders*, 23, 77-88.

Mallikarjun, B. 2002. Vocabulary education. *Language in India*. 26 Sep 2008. Available online: <http://www.languageinindia.com/November2002/Vocabulary.html>.

Marian, V., Blumenfeld, H. K. & Kaushanskaya, M. 2007. The language experience and proficiency questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. *Journal of Speech Language and Hearing Research*, 50/4, 940-967.

Morais, J. & d'Ydewalle, G. 2006. *Bilingualism and Second Language Acquisition*. Brussels: KVAB.

Paradis, M. 1997. The cognitive neuropsychology of bilingualism. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in Bilingualism: Psycholinguistic Perspectives* (pp. 331-54). Mahwah, NJ: Lawrence Erlbaum.

K. K. VISHNU
DST PROJECT,
ALL INDIA INSTITUTE OF SPEECH AND HEARING, MYSORE.
E-MAIL: <VISHNUSLP85@GMAIL.COM>

ARYA ABRAHAM
DEPARTMENT OF SPEECH AND HEARING,
FATHER MULLER MEDICAL COLLEGE, MANGALORE.

SAPNA BHAT
VISITING FACULTY,
SOUTHERN DENMARK UNIVERSITY, DENMARK.

&

SHYAMALA. K. CHENGAPPA
DEPARTMENT OF SPEECH AND LANGUAGE PATHOLOGY,
ALL INDIA INSTITUTE OF SPEECH AND HEARING, MYSORE.