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Bilingual Cognition - Effects of L2 on the Cognitive Decision of Shapes and Mass – A Report of the Cases of Japanese Bilinguals in Japan and in the UK

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1. Introduction

This research examines the cognitive states of bilingual speakers and investigates how their concepts are affected by two languages. Various studies have been reported on bilingualism, however it is rare to find the studies focusing on the cognitive states of bilingual speakers. Thus bilingual speakers are still simply categorised as people who have two separate minds, and bilingualism itself was once treated as a harmful psychological and social phenomenon (Dewarele, J.-M., Housen, A., and Wei, L 2003). The original idea of this research derives from a work of Imai and Gentner (1997, 2000), which discovered that monolingual Japanese speakers have a tendency in categorising objects depending on their substance while monolingual English speakers have a tendency in categorising them by their shapes. The work of Imai and Gentner suggests that having different L1 backgrounds makes this difference. In English there is mass-count difference, however in Japanese there is not such distinction in counting objects. In English nouns such as water and clay can not be directly modified by numerals and need unitizers to be quantified (i.e., a glass of water), however there is no such distinction in Japanese. Therefore having such a clear distinction in counting, monolingual English speakers tend to make a decision in categorising objects by shapes, while monolingual Japanese speakers tend to make a decision by materials. Based on Imai and Gentner's work, Cook, et al. (to appear) conducted experiments to investigate what kind of cognitive differences bilingual speakers have. The results suggest that Japanese-English bilinguals resided in the UK have a different concept from both monolingual English and Japanese monolingual speakers. This may mean that they have acquired a totally different concept as they acquired English as their second language. There was a difference amongst their performance depending on their English proficiency, however, even though their English proficiency was high, such subjects never behaved the same way as monolingual English speakers. The present research focuses on Japanese-English bilinguals residing in the UK and in Japan. The Japanese bilinguals in the UK are mostly university students using English in their daily lives. The latter group of bilinguals in Japan attend an immersion university where most of the subjects are taught in English. In other words both groups are exposed to English in every day life.

2. Method

2.1 Subjects

Two groups of Japanese-English bilingual subjects were required to participate to this experiment. The former group of 47 subjects are mostly students attending English universities enrolling either undergraduate or post-graduate courses. Also there are a few

faculty members of educational institutions such as a Japanese language school. The latter group of 75 students attend an immersion university in Japan where most of the lectures are delivered in English by either native speakers or English speakers with native level command. All the subjects were regarded to be from similar educational and economic backgrounds. Their previous English learning experiences were three years in junior high school and another three years in senior high school making six years in total. There were a few variations of English learning experiences before entering junior high schools such as attending an English conversation school. However such cases were found in both groups, and were thought to be with little effect for conducting the experiment.

2.2 Materials

All the objects used in this experiment were replica of the objects used in Imai and Gentner (1997). There were three object types, complex, simple, and substances. The complex objects utilise factory-made artefacts having complex shapes and specific functions (i.e., a lemon squeezer). The simple objects represent solid, simple-shape entities made out of a solid substance (i.e., a pyramid made with cork). The substances were made out of non-solid substances such as Nivea cream shaped into some forms (i.e. Nivea cream laid in a shape of reverse C). Each set consists of three objects. The subjects were shown the first object (i.e., a ceramic lemon squeezer), then shown two more objects (i.e., a wooden lemon squeezer and broken ceramic pieces) and were asked which of the two objects was considered to be the same with the first object. The below summarises all the objects we have adopted into this experiment. (See Imai & Gentner (1997, 4.2 Material) for more details about objects).

Type	Target Items		Test Items	
	Shape plus materials	label	Same shapes	Same materials
Complex objects	Ceramic lemon squeezer	Ejulem	Wooden lemon squeezer	Ceramic pieces
	Copper T junction	Evetty	Plastic T junction	Copper pieces
	Red plastic clip	Tapy	Metal clip	Red plastic pieces
	Wooden whisk	Luften	Plastic whisk	Pieces of wood
Simple objects	Cork pyramid	Nehear	Plastic pyramid	Cork piece
	Plastic flying saucer shape	Aniam	Wooden flying saucer shape	Pieces of plastic
	Red play-dough half egg	Mukol	Plastic half egg	Red play-dough pieces
	Orange wax kidney shape	Kelase	Purple plaster kidney shape	Orange wax pieces
Substance	Reverse C-shape in Nivea cream (white) ⊃	Onlar	Reverse C in transparent hair-gel	Blob of Nivea
	Foam capital gamma shape Γ	Muhaba	Clay gamma shape	Pile of foam
	Sawdust capital omega shape Ω	Kelede	Leather omega shape	Two piles of sawdust
	Sand S-shape	Storal	Glass beads in S-shape	Three piles of sand

There were four sets of objects in each group of complex, simple and substances. Hence all together 12 sets were tested by the subjects. Each object had a non-sense name. For example, the above example of lemon squeezer was named 'Ejulem'.

2.3 Procedure

2.3.1 English proficiency test

To begin with, English proficiency of the two groups of bilingual subjects was examined. The Paul Nation Vocabulary Test (established by Paul Nation in 1990) was adopted to

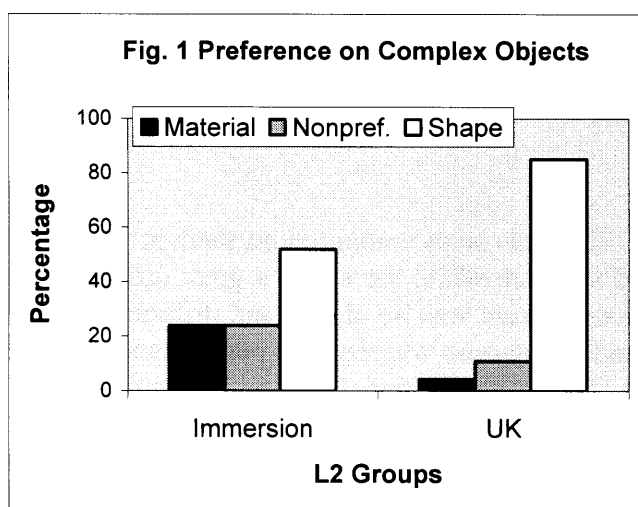
check the subjects' English proficiency. This is a commonly used language proficiency test to quickly check subjects' English proficiency levels, e.g., as a placement test for an English language school. This vocabulary test consists of 90 vocabulary questions spread in five bands (18 questions in each band) based on frequency levels. The lowest level A is selected from 1,000 most frequently used vocabulary, the next level B with 2,000, C with 3,000, D with 5,000, and the highest level of E with 10,000, that undergraduate university students should be familiar with. All the subjects were tested individually in a quiet room. It was found that the average score of the test for the immersion university students was 49.81, and 72.30 for the UK resident group. Having done the proficiency check, it was revealed that we have a variety of Japanese bilingual speakers as subjects with different English proficiency, which was an ideal setting to examine different types of bilinguals.

2.3.2 Experiments

As they finished the test, they proceeded to the actual experiment in another room, where one experimenter conducted the experiment while another kept the record of their answers. As shown in the Table 1 above, each experimental object was named with a nonsense name, e.g., the lemon squeezer was named 'Ejulem'. On showing the first object (i.e., a ceramic lemon squeezer), the experimenter announced 'This is 'Ejulem''. Uncovering the other two objects on plates (i.e., a wooden lemon squeezer and broken ceramic pieces) then, the experimenter asked the subjects 'Which plate has 'Ejulem'? All the instructions were conducted in Japanese¹.

3. Results: The preference on each type of object - The cases of bilinguals in Japan and in the UK

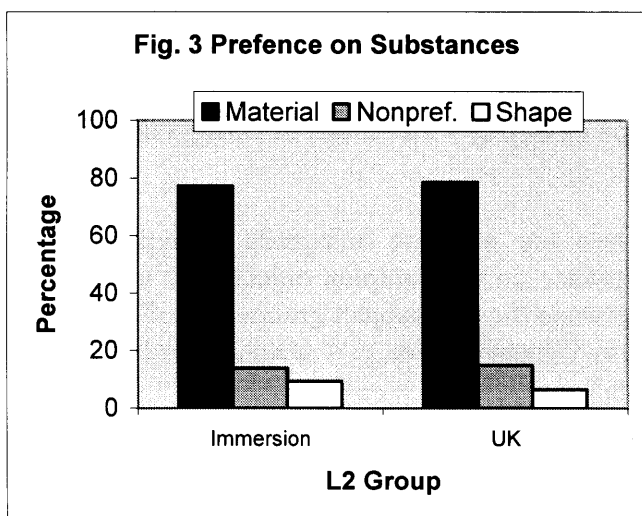
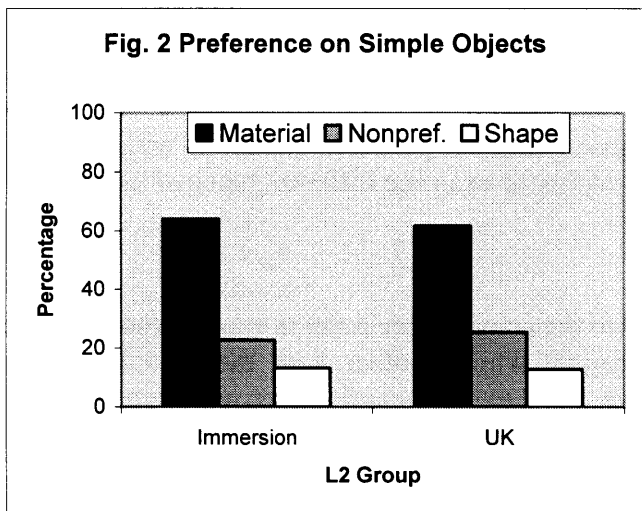
The figures below from 1 to 3 show how the Japanese bilinguals performed on the experiments. Figure 1 shows the performance on the complex objects and as it can be seen in the figure, there is a difference between the two subject groups. The difference of the results is statistically significant (Mann-Whitney U test, $p < .0009$, exact significance, 2-tailed).



The results in the Figures 2 and 3, on the other hand, are not appeared to be statistically

¹ 'This is 'Ejulem'.' was announced as 'kore wa 'Ejulem' desu.' 'Which plate has 'Ejulem'?' was announce as 'dochira no osara ni 'Ejulem' ga notte imasuka.'

significant. Although the two groups show a slight difference in degrees, there is no statistically significant difference between them. The significance levels of the difference between the two groups are: Simple, $p = .857$; and Substance, $p = .947$ (Mann-Whitney U test, exact significance, 2-tailed). This means that while their English proficiency differs largely, their cognitive states can be said the same for those types of objects.



4. Conclusion

In this research two groups of Japanese bilinguals were compared on their performance on categorising objects. What was found was that while there was a great difference in their L2 proficiency between the two groups, there was no significant difference in the actual performance for simple objects and substances whereas the performance for the complex objects appeared to be different. This suggests that either the L2 proficiency or the L2 using environment has affected on the subjects' cognitive states on complex objects while neither can affect on the cognitive decisions with simple objects and with substances. At this stage of the present research, it cannot be said that which one has the key role. Further, looking at details of the subjects, various proficiency differences were seen within the groups. For example, there were a few very low proficiency subjects in the UK group and very high proficiency subjects in the immersion group. Therefore more precise analysis according to the English proficiency seems to be required in order to

investigate the actual effect of L2 on bilingual cognition.

Discussion

As presented above, an interesting result was found in the case of complex objects. It has been argued in the study of Imai & Gentner (1997) that it is a human tendency to choose shape for the complex objects due to the function attached to the objects and no difference is expected across different language groups. However even for such tendency, statistically significant difference was found in this research between the two bilingual groups. Even though the subjects chose shape for the complex objects, it was not as straight forward as the case of Imai & Gentner. We assume that an immersion setting might be the key because a similar result was reported in Kasai & Takahashi (2005) that the Immersion group appeared to be different from other groups. One possibility is that the Immersion group has a great degree of exposure to English as they live in Japan. In other words they are exposed to two different languages within the same living environment. This can be interpreted that they are cognitively affected by those different languages due to such bilingual environment. Although a thorough investigation is obviously required, it could be, however, a finding that supports the Multi-Competence Theory proposed by Cook (e.g., 1999, 2002), in which L2 learners take individually different routes to arrive at different L2 status.

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