Do bilinguals think differently from monolinguals? Evidence from non-linguistic cognitive categorisation of objects in Japanese-English bilinguals*

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Abstract

Recent advances in the investigation of the relationship between language and cognition have demonstrated that speakers of English categorise objects based on their common shape, while speakers of Yucatec and Japanese categorise objects based on their common material (Lucy & Gaskins 2003; Imai & Mazuka 2003). The current study extends that investigation to the domain of bilingualism. Results from a cognitive categorisation task show that intermediate Japanese L2 English speakers behaved similarly to Japanese monolinguals, while advanced Japanese L2 English speakers behaved similarly to English monolinguals. The implications of these findings for bilingualism and second language acquisition are discussed.

Keywords: Bilingual Cognition, Second Language Acquisition, Language and Thought

1. Introduction

To what extent does the language we speak influence the way we think? This question, also known as the 'linguistic relativity hypothesis' and made famous in the twentieth century by the linguist Edward Sapir and his student Benjamin Lee Whorf (1956), has instigated debate and research in the disciplines of philosophy, linguistics and psychology for a century and possibly longer (for a historical overview see Lucy 1992a). A strong, 'traditional' version of linguistic relativity would be to assume that thought is shaped, limited and constrained by language, so that if our language does not express a certain concept then we do not have that concept in our mind at all. This view however is not compatible with common sense. One can understand concepts without being able to express them linguistically. In our everyday use of language we often cannot find the words to 'say what we mean'.

More recently, however, a new 'weak' version of linguistic relativity has been explored in the field of cognitive psychology: certain linguistic properties may predispose speakers of languages that have those properties to *prefer* one kind of cognitive representation over another, without suggesting that speaking a particular

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language forces one kind of representation rather than another (for a discussion see Hunt & Agnoli's 1991 seminal paper on the issue).

This more plausible version has been empirically supported in a number of recent studies (Lucy 1992b; Imai & Gentner 1997; Lucy & Gaskins 2001, 2003; Imai & Mazuka 2003), which have suggested that there may be a link between the way a language quantifies nominals and the way speakers of that language perform in object classification tasks such as the triads matching task. This task requires decisions to be made about the similarity between objects based on common shape or common material. Participants are presented with a standard object made from a certain material and having a certain shape, e.g. a wooden spoon. They are then presented with two other objects, one matching the standard object in material but having a different shape, e.g. a wooden spatula, and one matching the standard object in shape but made from a different material, e.g. a plastic spoon. Participants are asked to match one of the two choices with the standard object. Results in previous studies have shown that speakers of English tend to make a shape match significantly more than speakers of Japanese/Yucatec when the standard object is a countable entity (e.g. a spoon). However, when the standard object is a non-countable substance (e.g. sand) the differences between the speakers of English and the speakers of Yucatec/Japanese diminish (Lucy & Gaskins 2003).

The claim in Lucy (1992) and Lucy & Gaskins (2003) seems to be that in Yucatec/Japanese all common nouns that refer to inanimate entities are in a sense 'mass', and their referents are perceived as non-individuated entities. For example, all common nouns in Japanese cannot take grammatical number marking and cannot be modified directly by numerals (e.g. **san ringo* 'three apple'). In order to express countability, languages like Japanese and Yucatec require unitizers, which are also called classifiers, with numerals (e.g. *san ko no ringo* (≈ three piece of apple) 'three apples').

In English, however, there is an important subdivision within the nominal domain: there are mass nouns which cannot take grammatical number marking, cannot be modified by numerals directly and require unitizers in order to be countable, e.g. **three waters/three glasses of water*. On the other hand, English also has count nouns with an inherent unit reference, which nouns in classifier languages lack. This means that count nouns in English take obligatory number marking and direct numeral modification (e.g. *three apples*). Perceptually, this inherent unit is usually the form or shape of the object. Lucy's (1992) claim then seems to be that the best perceptual indicator of individuation is the shape of objects and that use of certain grammatical patterns for number marking routinely draws speakers' attention to the shape or material properties of objects.

If the degree to which speakers of different languages attend to the shape/material characteristics of different types of objects is relative to the degree to which individuation is emphasized in the nominal systems of their language, this raises some very interesting questions about speakers of a second language (L2) with different nominal properties from their first (L1). For example, what will the consequences for cognition be in Japanese speakers of English as a second language?

The current study aims to answer that question, thus complementing recent attempts to investigate the issue of linguistic relativity in relation to bilingualism (Green 1998; Athanasopoulos 2006; Cook et al. in press). If our native language draws our attention to those aspects of reality that are encoded in its grammar, can the acquisition of an L2 with different grammatical properties from the L1 redirect our attention according to the grammatical distinctions made in our L2?

To begin to address this question, a triads matching task was conducted where equal numbers of objects corresponding to singular count and mass nouns in English were presented to English and Japanese monolinguals, as well as to Japanese speakers of English as a second language. Thus there were two experimental conditions, a count condition, where the standard object was a solid entity that can be labelled in English as a count noun (e.g. a spoon), and a mass condition where the standard object was a substance that can be labelled in English as a mass noun (e.g. pepper). In order to be able to correlate cognitive performance with L2 proficiency, a general proficiency test was given to the L2 speakers, namely the Oxford Quick Placement Test (QPT 2001). In addition to that, a grammaticality judgement task was given to the L2 speakers, specifically assessing knowledge of number marking in English.

2. Method

2.1 Participants

The participants were 20 monolingual English-speaking adults (mean age 24.8 years, age-range 18-50, 11 female, 9 male), 20 monolingual Japanese-speaking adults (mean age 20.8, age-range 19-24, all female), and 32 Japanese speakers of L2 English. These were subsequently separated into two groups based on how they scored in the QPT and the grammaticality judgement task: An intermediate group (n = 16, mean age 23.1, age-range 19-41, 15 female, 1 male) and an advanced group (n = 16, mean age 27.4, age-range 20-41, 15 female, 1 male). Table 1 shows the L2 speakers' mean scores in the QPT and the grammaticality judgement task[1].

Table 1. L2 speakers' mean (%) scores in the QPT and the grammaticality judgement task. (All figures are rounded to the nearest whole number)

L2 Groups	*QPT*	*Plural –s suppliance*
Advanced (n = 16)	84	88
Intermediate (n = 16)	66	68

Independent samples t-tests showed that the differences between the groups were statistically significant in both the QPT ($t(30) = 9.683$, $p < 0.05$) and the grammaticality judgement task ($t(30) = 3.203$, $p < 0.05$).

At the time of testing, the L2 speakers had all been living in the UK for more or less the same amount of time. The mean length of stay of the intermediate group was 6.6 months, range 3-24 months. The mean length of stay of the advanced group was 7.6 months, range 3-20 months. The participants in all groups were University students, either in the UK or Japan, and had similar socio-economic backgrounds. The L2 speakers had all started learning English after the age of 12.

[1] The grammaticality judgement task consisted of a text in English containing mistakes in the suppliance of the plural morpheme –s in required contexts. There were also other types of grammatical mistakes to act as distracters. The L2 speakers were instructed to underline any part of the text which had mistakes and write the correction underneath. The responses for each participant were scored by calculating the ratio of correct suppliance of plural *–s* to the number of required contexts. Scores were then converted into percentages and the mean was calculated for each group (see Table 1).

2.2 Materials

The materials are summarized in Table 2. In the count condition the standard was an entity that can be coded lexically as a count noun. Most of these included solid simple-shaped objects. The shape alternate was the same object as the standard object, only made from a different material. The material alternate was an object made from the same material as the standard object, but differing in shape. In the mass condition, the standard was an entity that can be coded lexically as a mass noun. Most of these included non-solid substances arranged into a simple shape. The shape alternate was an entity that was arranged into the same shape as the standard entity, but made from a different material. The material alternate was a single portion or some portions of the standard entity arranged into a different shape. Many of the materials used are replicated versions of materials used previously by Imai & Gentner (1997) and Cook et al. (in press).

Table 2. List of materials arranged in triads

(a) Count Condition

Standard	*Shape alternate*	*Material alternate*
Plastic clip	Metal clip	Plastic pieces
Wooden spoon	Plastic spoon	Stick of wood
Candle	Candle-shaped wood	Piece of wax
Cork pyramid	Plastic pyramid	Chunk of cork
Plastic UFO	Wooden UFO	Piece of plastic
Wax kidney	Plaster kidney	Wax pieces

(b) Mass Condition

Standard	*Shape alternate*	*Material alternate*
Toothpaste arch	Plasticine arch	Pile of toothpaste
Stick of chalk	Stick of wax	Pile of chalk
Pepper upside down V	Toothpaste upside down V	Pile of pepper
Sawdust upside down Ω	Leather upside down Ω	Two piles of sawdust
Decoration sand reverse S	Glass reverse S	Three piles of sand
Nivea cream reverse C	Plasticine reverse C	Nivea cream pile

2.3 Procedure

Each participant was tested individually. The English monolinguals and the L2 speakers were tested either at a private home in the UK, or in a room at the University of Essex in the UK. The Japanese monolinguals were all tested in a room at Gunma Prefectural Women's University in Japan.

There were six trials for each condition. Thus each participant received a total of twelve trials. In each trial, the participant was presented with a triad of a standard and two alternates, shape or material. All entities were presented on white paper plates and were covered with a piece of paper. During each trial, the standard was uncovered first, and participants were prompted to pay attention to it. Then the two alternates were uncovered and the participants were prompted to point to the entity that is the 'same' as the standard. The language of instruction was English except for the Japanese monolinguals where the language of instruction was Japanese, therefore a Japanese interpreter was used. The instruction in English was "Show me which is the same as

this". The instruction in Japanese was "*Kore* (this) *to* (with) *onaji-nano* (same) *wa* (topic-marker) *docchi* (which) *desuka* (is)" (cf. Imai & Mazuka 2003). Participants were instructed to make their decision at their own pace and according to their own opinion. The order in which the trials were presented was randomised for each participant. The L2 speakers conducted the grammaticality judgement task and the QPT after they had completed the cognitive task.

3. Results

Responses were scored as the number of times each participant selected a shape or material alternate in each condition. Scores were then converted into percentages and the mean was calculated for each group of participants. In Table 3 a summary of those mean scores is presented.

Table 3. Summary of mean number of times each group chose shape or material in the two conditions. (Figures are rounded to the nearest whole number)

	Count Condition		*Mass Condition*	
Groups	*Mean % shape preference*	*Mean % material preference*	*Mean % shape preference*	*Mean % material preference*
English (n = 20)	83	17	42	58
L2advanced (n = 16)	84	16	51	49
L2intermediate (n = 16)	60	40	38	62
Japanese (n = 20)	60	40	49	51

To examine the overall pattern, a 4 (Group) x 2 (Condition) mixed ANOVA (with Group as a between-subjects factor and Condition as a within-subjects factor) was conducted. It is evident from Table 3 that the proportion of material responding is 1 minus the proportion of shape responding, therefore for the statistical analysis the frequency of shape responses in each condition was the dependent variable.

There was a significant main effect of condition, indicating that the proportion of shape responses differed across the two conditions ($F(1, 68) = 51.870$, $p < 0.05$). The main effect of groups was very close to significance ($F(3, 68) = 2.420$, $p = 0.07$) indicating that there may be similarities as well as differences between groups in the proportion of shape responses. Crucially, there was a significant Group x Condition interaction ($F(3, 68) = 3.371$, $p < 0.05$). This indicates that the way the participants made their shape preferences in the two conditions differed across the four groups.

In order to examine more closely the proportion of shape responses in each condition across the four groups, separate One Way ANOVAs were conducted. These showed a significant main effect of group in the Count Condition ($F(3, 68) = 4.813$, $p < 0.05$). Post-hoc Bonferroni tests showed that the English monolinguals and the advanced L2 speakers selected the shape alternate significantly more than the Japanese monolinguals ($p < 0.05$). The intermediate L2 speakers did not differ significantly from any group ($p > 0.05$). In the Mass Condition, the main effect of group was not significant ($F(3, 76) < 1$).

4. Discussion

The results from the monolingual participants support the basic insight of Lucy's (1992) work. The cognitive differences and similarities match neatly the grammatical differences and similarities between English and Japanese in how they mark number on the noun phrase. However, the most interesting finding is the cognitive behaviour of the L2 speakers. In the mass condition, no differences were found and none were expected since the monolingual groups performed similarly to each other. In the count condition on the other hand, the advanced L2 speakers selected shape significantly more than the Japanese monolinguals while their performance was very close to that of the English monolinguals. The pattern of the intermediate L2 group however was not as clear-cut. Although their performance was not significantly different from that of the Japanese monolinguals, it was also not significantly different from that of the other two groups, i.e. there are some indications of an on-going cognitive shift from the L1 pattern towards the L2 pattern.

An important question to ask then is how much knowledge of grammatical number marking in English do L2 speakers need to have in order for their cognition to shift? In order to provide an answer to that question, each L2 speaker's score in the count condition of the cognitive task was paired with his/her score in the grammaticality judgement task. A Pearson's correlation coefficient was performed whereby the two groups of L2 speakers were pooled together in one group ($n = 32$). The statistical analysis shows that there is a strong correlation between the L2 speakers' cognitive and linguistic performance ($r = 0.715$, $p < 0.05$). This demonstrates that the more successful the L2 learners are in the grammaticality judgement of number marking in the L2, the more they behave like monolingual speakers of their L2 in the cognitive task. This significant correlation suggests that, with a few exceptions, the majority of the L2 speakers must have native-like or near native-like knowledge of number in order for their cognition to totally resemble that of native speakers of their L2.

These results have important implications for the relationship between language and cognitive processing in the bilingual mind. They are in line with Athanasopoulos' (2006) and Cook et al's (in press) previous results from similar experiments, and suggest that bilinguals are cognitively different from monolinguals, thus supporting Cook's (2002) multi-competence hypothesis and Bialystok's (2002, 2004) claim that bilingualism has effects on non-linguistic cognition. However, the current data also suggest that changes in the cognition of bilingual speakers are not simply the product of knowing or using any two languages. Rather, one needs to think about it in terms of the specific languages involved, and the level of proficiency reached. In this case, the cognition of advanced L2 speakers agrees with specific linguistic properties, i.e. grammatical number marking, which is present in their L2 but absent, or less marked, in their L1.

Furthermore, the cognitive changes in L2 speakers are analogous to the level of L2 knowledge that they have. It seems that in this particular case, these changes are more apparent in Japanese speakers who have reached or are near ultimate attainment in the L2, not only in terms of general proficiency, but also in terms of the specific L2 grammatical properties involved. Further research on bilingual cognition should take these observations into careful consideration, particularly when investigating bilingual speakers with typologically different languages and when assessing the L2 proficiency of those speakers.

The type of research undertaken in this paper may also have implications for second language acquisition theories. Specifically, it may provide a different kind of evidence

from linguistic data to answer a central question in the field, that is, which resources of the mind are available to L2 learners. More specifically, whether the innate mechanism for learning language, Universal Grammar (Chomsky 1986), is available to L2 learners in the same way that it is available to L1 learners (Full Access Hypothesis, Schwartz & Sprouse 1994) or whether, because of maturational constraints, UG ceases to be available and post-childhood L2 learners have to rely on other metalinguistic learning strategies when learning an L2 (see e.g. Meisel 1997). The evidence from the current study seems to be in line with the proponents of the Full Access Hypothesis. In fact, the cognitive patterns observed in the current study are consistent with Schwartz & Sprouse's (1994) hypothesis, that L2 learners initially transfer all the L1 linguistic properties into the L2 grammar, but then, as acquisition progresses, they manage to reset these parameters to the L2 settings, i.e. UG is fully accessible to L2 learners after an initial period of transfer from the L1.

Given that this kind of research is at its early stages, there are many caveats and questions for further research that must be acknowledged. First of all, why does the L2 grammatical pattern override the L1 pattern in cognitive categorisation tasks of the kind used here? Two tentative explanations, both inviting further research, can be offered: Firstly, English is more marked than Japanese with regard to number marking, and this is why the cognition of Japanese L2 English learners is redirected towards the L2 pattern. If this were true, then it would be interesting to investigate the cognitive behaviour of English learners of L2 Japanese in the same task in order to see if their cognition will change to the same degree as that of Japanese learners of L2 English. Secondly, there may be effects of language mode (Grosjean 2001). Under this explanation, the L2 speakers were following the L2 pattern because the instructions were given in their L2. Cook et al. (in press), who conducted a similar experiment with instructions in the L1 found that the cognitive behaviour of L2 speakers shifted from the L1 pattern towards the L2 pattern, but to a lesser degree than that demonstrated in the current study. Thus language mode may well be a factor in determining the degree to which cognitive behaviour may change.

There are also other factors to consider in future research. Firstly, the bilinguals investigated in this study are 'late' bilinguals, in the sense that they acquired the L2 after child-hood. How will early bilinguals behave in the same task? For example, the language that may influence cognition may be the one that is used most often, regardless of the degree of markedness of number marking. Secondly, further research could discriminate length of exposure and L2 proficiency more rigorously, by comparing advanced L2 speakers who have never lived in the L2-speaking environment before with L2 speakers who have.

5. Conclusion

It is obvious that the current investigation invites further research, and the explanation and implications of the results offered here are only tentative. As mentioned earlier, the revival of the linguistic relativity hypothesis has provided a new experimental paradigm in the investigation of the relationship between language and other cognitive domains. Applying that paradigm to an L2 research context will enhance our understanding of the relationship between language and cognitive processing in the bilingual mind and may have important implications for L2 acquisition theories.

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