Bilingualism and Cognitive Development: Evidence from Scalar Implicatures

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Introduction

One of the most enduring issues in developmental psychology concerns the influence of language on cognitive development. However, the effects of the timing and nature of language input are not well understood.

The aim of the work reported here was to test the hypothesis that bilingualism confers an advantage on cognitive development in terms of children's understanding of the implications of messages as intended by speakers in conversation.

Introduction

We report the results of an experiment designed to examine the effects of bilingualism on children's appreciation of scalar implicatures - a key aspect of cognitive development that concerns children's conversational understanding (Siegal & Surian, 2004, in press). This involves the knowledge that the use of the term some pragmatically means not all (e.g., that the statement Some of the dwarfs kissed Snow White implies that not all the dwarfs did). We report a study of children aged 4-6 years who are either monolingual in Japanese or English or bilingual in the two languages.

Some notes on ‘bilingualism’

Many researchers agree that the term ‘bilingualism’ is a broad and vague term.

Some notes on ‘bilingualism’

Bloomfield (1933) ‘Bilinguals should demonstrate complete fluency in both of their languages.’

Grosjean (1989) ‘Bilinguals need to demonstrate the capability to use each language to satisfy their communicative needs.’

Some notes on ‘bilingualism’

A sampling of terms (Wei 2000)

Achieved bilingual, additive bilingual, am bilingual; ascendant bilingual; ascribed bilingual; asymmetrical bilingual, balanced bilingual; compound bilingual, consecutive bilingual; co-ordinate bilingual; covert bilingual, diagonal bilingual, dominant bilingual; dormant bilingual, early bilingual, equilingual; functional bilingual, horizontal bilingual, inopert bilingual, late bilingual, maximal bilingual, minimal bilingual, natural bilingual, passive bilingual, primary bilingual, productive bilingual, receptive bilingual, recessive bilingual, secondary bilingual, semilingual, simultaneous bilingual, subordinate bilingual, subtractive bilingual, successive bilingual, symmetrical bilingual, vertical bilingual
To be more precise...
(1) children from mixed marriages where one of the parents was Japanese and the other was English (18 families)
(2) children who had Japanese parents but were in England for their fathers' business (6 families)
(3) children who had English parents but were in Japan for their parents' business. (13 families)
But only fairly balanced bilinguals were included to ensure that their levels of proficiency did not differ from those of the monolinguals tested

Do bilinguals excel in anything?
• Metalinguistic awareness (Cromdal, 1999)
• 'word', 'syntactic', 'phonological' awareness (Bialystok, 2001)
• Bilingual processing promotes 'control of attention' but their ability to represent information stays at a monolingual level. (Bialystok and Senman, 2004)

Do bilinguals excel in pragmatics?
• Sensitivity to the communicative context (Genesee, Nicoladis and Paradis, 1995)
• Bilingual are more sensitive to visible/invisible referents (Genesee, Tucker and Lambert, 1975)

Current Study
• Effect of bilingualism upon scalar implicatures (this type of pragmatic skills have not been investigated amongst bilinguals) as well as upon attentional tasks
• The strength of language interference (Japanese-English)

Participants
These consisted of three groups of children aged 4 to 6 years:
(1) 21 English monolinguals tested in England
(2) 23 Japanese monolinguals tested in Japan
(3) 20 Japanese-English bilinguals tested in England or Japan

Hypotheses
• Bilinguals would demonstrate enhanced performance on the two attentional tasks, (Bialystok and Shapero, 2005)
• Bilinguals would demonstrate superior performance on the scalar implicature task,
Procedure

All children were given three types of measures:

1. **Verbal mental age** (VMA) based on the BPVS and JPVT
2. **Executive functioning** (EF) that, following Biastock and Shapero (2005), consisted of the Day-Night (DN) task in which children were required to inhibit familiar response that the sun refers to day and the moon to night (maximum score = 16) and the Card Sort (CS) task in which children are required to shift their focus in sorting cards from shape to colour (maximum score = 18).

Day and Night task (Hong and Diamond, 1994)

![Day and Night task](image)

Wisconsin card-sorting task (Woolfe, Want and Siegal, 2002)

![Wisconsin card-sorting task](image)

Two sets differed from each other in terms of the shapes and the colors

![Shapes and colors](image)

Pragmatic Task

(3) **Scalar Implicature** (SI) tasks in which children were required to judge whether a puppet had appropriately described an event. The procedure followed that of Papafragou and Musolino (2003). For each SI task, a puppet commented on the behaviour of a story character, for example, a teddy bear was shown having placed all five available hoops on a pole. The description was made in terms of the Japanese language, e.g., teddy as having put some of the hoops on the pole. The child was asked to say whether the puppet had described the event well. A maximum SI score of 4 could be obtained.

The Japanese monolinguals and the bilinguals were tested in Japanese except for the BPVT.

The English monolinguals were tested in English.
What is scalar implicature?

Some subjects showed the tendency that we were looking for.

The weak quantifier: some is used for a reason:


Gricean Maxim of Informativeness (or Quantity)

Make your contribution as informative as is required.

Do not make your contribution more informative than is required.

(Grice 1989)

The difference between what is said that what is meant!

Scalar implicature warm-up item

Following Papagravou & Musolino, 2003, we included some training sentences in the experiment so that the children will be aware that their task is to detect pragmatic anomaly.

The puppet said ‘this is an yellow fruit that we can eat’ or ‘this is an yellow animal with four legs’, pointing at a banana or a lion.

The puppet’s statement is truth conditionally true but pragmatically infelicitous.

Scalar implicature sample story

This bear is very good at putting hoops on the pole. Look, here are four hoops and see what the bear has done!

The puppet: The bear put some of the hoops on the pole.

The puppet: kuma-san-wa ikutuka no waro bou-ni hamemasita.

Did the puppet describe the event well?

Results

The bilingual children significantly outperformed the two monolingual groups, $F (2, 61) = 10.78, p < .001$ in the SI task, even though their English verbal mental age of the bilinguals significantly lagged behind those of the English monolinguals, $t (39) = 3.61, p < .001$.

Table (Summary of three tasks)

<table>
<thead>
<tr>
<th>Language group</th>
<th>N</th>
<th>Age (mos)</th>
<th>EVMA</th>
<th>XMA</th>
<th>DN/16</th>
<th>CS/10</th>
<th>SL/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>English monolingual</td>
<td>21</td>
<td>64.2 (8.8)</td>
<td>67.7 (8.1)</td>
<td>NA</td>
<td>11.8 (3.4)</td>
<td>8.1 (1.5)</td>
<td>1.43 (1.5)</td>
</tr>
<tr>
<td>Japanese monolingual</td>
<td>23</td>
<td>63.3 (9.0)</td>
<td>NA</td>
<td>63.3 (10.1)</td>
<td>12.2 (4.0)</td>
<td>8.6 (2.0)</td>
<td>0.35 (0.8)</td>
</tr>
<tr>
<td>Bilingual</td>
<td>20</td>
<td>65.1 (12.4)</td>
<td>53.5 (15.7)</td>
<td>59.9 (10.3)</td>
<td>13.1 (4.3)</td>
<td>8.6 (2.1)</td>
<td>2.30 (1.7)</td>
</tr>
</tbody>
</table>
Results (SI score distributions)

<table>
<thead>
<tr>
<th>Bilinguals</th>
<th>SI score 0-2</th>
<th>SI score 3-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>16</td>
<td>5</td>
</tr>
</tbody>
</table>

Further investigation

- To further investigate the effect of language proficiency on SI performance, a different subgroup of English monolingual (5&6 year olds) was selected for a language group comparison
- matched on the basis of chronological rather than verbal mental age (a language proficiency of over 2 years in advance of bilinguals)

 SI score distributions for 5 and 6 year olds

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<th>SI score 3-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>English</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

Further investigation results

- Further examination of the relationship between language proficiency and SI scores failed to reveal a significant correlation

a binomial analysis

- the number of bilingual children 5 and 6 year olds achieving the maximum score of 4 out of 4 on the SI task was still significantly more than would be expected by chance (p<0.0001), in contrast to the number of English monolinguals from either the Low VA or High VA subgroups of English monolingual 5 and 6 year olds (p>'0.05) and the Japanese monolingual 5 and 6 year olds (p>0.05)

Overall results

- These findings suggest that access to more than one language can facilitate certain key aspects of pragmatic development.
Research questions

The purpose of this investigation
• to establish whether bilinguals demonstrated superiority in the appreciation of the some-
al scalar implicature
• to ascertain whether attention played a mediating role in any found advantage

Table (Summary of three tasks)

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<th>CS/10</th>
<th>DN/16</th>
<th>DS/16</th>
</tr>
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Conclusion

• bilinguals did demonstrate significantly enhanced performance on the implicature task. Furthermore this pragmatic advantage seemed to be attributable to a non-linguistic consequence of bilingualism.
• bilinguals were not found to display superior attentional skills and attentional ability did not appear to relate to implicature appreciation.
• the validity of the attentional assessments used in this study

Selected references


Acknowledgment

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