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A lexical decision experiment with onomatopoeic, sound symbolic and arbitrary words

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Abstract

A lexical decision test was done on onomatopoeic, sound symbolic and arbitrary words in order to find out if there were differences in processing times and error rates between these words.

The test was used in an unconventional way in order to see if non-words, modelled on onomatopoeic and sound symbolic words, would behave like established words and have shorter reaction times.

The results show, on the contrary, that established onomatopoeic and sound symbolic words have significantly longer reactions times than arbitrary words. They are also more often confused with non-words than are the arbitrary words.

Introduction

This experiment springs out of my earlier work on the nature of onomatopoeic and sound symbolic words – especially as manifested in initial consonant clusters. That work has focussed on lexical analysis and on different experiments on the understanding and production of constructed nonsense-words.

Onomatopoeic and sound symbolic words are now and then created, by speakers or writers, in quite predictable ways. (For a recent overview of the subject see Hinton et al., 1995). The present purpose was to find out how real and constructed – onomatopoeic or sound symbolic – words behave in relation to arbitrary words, in a lexical decision experiment. In previous lexical decision experiments one finding is that non-words are recognized more slowly than real words are. ("Real words" are, words that are either found in a modern dictionary or judged by speakers to be lexicalized, i.e. not neologisms.)

One question is now if non-words made up from onomatopoeic and sound symbolic words are recognized more quickly than nonsense words constructed from arbitrary words are.

Hypotheses

The research hypotheses were the following:

1. Onomatopoeic and sound symbolic words will more often be responded to incorrectly as compared with arbitrary words.
2. These words will also have longer reaction times than arbitrary words.
3. Non-words constructed from consonant clusters typical for onomatopoeic and sound symbolic words will also be responded to more incorrectly than nonsense words constructed from arbitrary words.
4. These words will also have longer reaction times than nonsense words constructed from arbitrary words.

Construction of the test

In accordance with standard lexical decision experiments the lexical material consists of 6 groups of words:

A B C
D E F

Group A, in the present experiment, contains 20 ordinary onomatopoeic words, group B: 20 ordinary sound symbolic words, group C: 20 arbitrary words. Out of 60 more words distributed on these groups, three groups of non-words are made. (Non-words are made out of existing words by changing the word so that it differs from any other word by at least 2 graphemes.) Group D contains words made out of onomatopoeic words, e.g. skvynja (from skvala), group E words from sound symbolic words, e.g. klejsa (from kletal), and finally, group F, words from arbitrary words, e.g. ligla (from lugna). The initial consonants of the words are always preserved since the beginning has been the main interest in my previous studies.

One and the same initial consonant cluster may be used in either sound symbolic and onomatopoeic words or in non sound symbolic/onomatopoeic (ordinary) words, e.g. fl- in fladdra (flutter) or flyutta (move). However,
this is made into a non-word (preserving the initial cluster) the resulting word tends to get an onomatopoeic/sound symbolic flavour, e.g. drussa out of dricka (cf. Sigurd, 1993). The present test tries (a bit unnaturally) to reserve certain clusters for onomopoeia, others for sound symbolism and often no clusters for arbitrary words. The division between onomatopoeic and sound symbolic clusters is based on tendencies observed in the lexical analysis.

Lexical decision experiments have shown that more frequent words are recognized quicker than more infrequent ones. Therefore the stimuli are controlled for frequency following Allen. A word of caution: these frequencies are based on newspaper articles while the words in the test mostly belong to the spoken language. As a consequence of this the onomatopoeic words often have a frequency of 0. Accordingly the arbitrary words (group C and those underlying F) chosen have a very low frequency.

Procedure
The participants in the experiment were 17 first semester students at the linguistics department. Most of them were around 20 years of age.

They did the test one at a time at the computer. The experiment was run in a standard way (cf. Shoben, 1982; Laine, 1990), with stimuli differently randomized for each participant and with half of the participants having reversed position of the yes-no buttons.

None of the participants judged the task to be difficult or tiring.

Results
A part of the results will now be presented:

Incorrect reactions
Table 1. Number of incorrect yes/no-responses for the six word groups.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>27</td>
<td>7</td>
<td>8</td>
<td>18</td>
<td>8</td>
</tr>
</tbody>
</table>

Among the real words, stimulus type B (sound symbolic words) yielded the highest number of mistakes, 27. Onomatopoeic words showed 17 mistakes while the arbitrary words showed only 7 mistakes. In other words, participants were more unsure of whether onomatopoeic and sound symbolic words were real or not. This confirms hypothesis 1.

When words having a single error are excluded the most erroneous group is still B followed by E, then A.

Real onomatopoeic and sound symbolic words were judged as non-words more often than the corresponding non-words were judged as real ones.

Among the non-words, stimulus type E (modeled on sound symbolic words) showed the highest number of mistakes, 18. Stimulus type D (modeled on onomatopoeic words) showed 8 mistakes while stimulus type F showed 8 mistakes. The sound symbolic but not the onomatopoeic words are in accordance with hypothesis 3.

The error rate of the subjects varied between 1 and 12 with a mean of 5.6.

Two consonant clusters
The words of stimuli A and B begin with two- or three-consonant clusters while a higher proportion of the words of stimuli C begin with one consonant or a vowel.

However, the stimuli C words beginning with two or three consonsonsants are not among the few that get confused (if they were, that would mean that the lower amount of confusion among C words could depend on the lower number of words beginning with consonant clusters).

A replication of the experiment with stimuli C words consisting of only consonant clusters beginings seems unnecessary.

Reaction times
Most of the subjects showed a similar pattern of reaction times.

Some tendencies seem quite clear just from looking at the data. The most common pattern – for each subject – is that stimuli C showed the
for each subject - is that stimuli C showed the shortest reaction times (coupled with lowest error rate), stimuli A and B a longer reaction time, while the non-words had the longest reaction times.

Table 2. Reaction times (in seconds) of the six word groups.

<table>
<thead>
<tr>
<th>word types</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>real word</td>
<td>0.93</td>
<td>0.94</td>
<td>0.81</td>
</tr>
<tr>
<td>non-words</td>
<td>D</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>1.11</td>
<td>1.17</td>
<td>1.13</td>
</tr>
</tbody>
</table>

A multivariate analysis of variance showed the result to be highly significant.

Comparing missjudgements with lengths of reaction times (reaction times over 3 seconds are automatically excluded by the test program) a pattern emerges.

Type B and E (sound symbolic clusters) yield the highest number of mistakes and the longest reactions times, within their respective groups (words and non-words). B is however most erroneous while E is slowest. Type C has the fewest mistakes and the shortest reaction times.

Reaction times of individuals
13 out of 17 subjects showed the shortest reaction times for real words and 14 out of 17 subjects performed quickest on arbitrary words.

The E non-words are slower than the other non-words for 10 of the 17 subjects.

The subject with the longest mean reaction time made 10 mistakes while the person with the second to shortest mean reaction time made 1 mistake.

There seems to be a correlation between error rate and reaction time, both for individual words and for individual subjects.

Reaction times for two-consonant clusters
For the reaction times, as well as the error rates, there is a problem with the words of stimuli A and B that begin with two- or three-consonant clusters while the words of stimuli C more often begin with one consonant or a vowel. However, the pattern is the same for this word group:

Conclusions
Hypothesis 1 was verified but not hypotheses 3 and 4.

References