Dissociating Implicit and Explicit Learning of Syntactic Rules

Patrick Rebuschat (pr277@cam.ac.uk)
RCEAL, University of Cambridge, 9 West Road, Cambridge CB3 9DP, UK

John N. Williams (jnw12@cam.ac.uk)
RCEAL, University of Cambridge, 9 West Road, Cambridge CB3 9DP, UK

Keywords: Implicit learning; explicit learning; syntax; Artificial Grammar Learning; language acquisition

Introduction

It is common to refer to language acquisition as a real-world phenomenon where most learning proceeds implicitly, i.e. independently of the deliberate intention to learn and in the absence of awareness of what was learned. At the same time, however, little effort has been made, in implicit learning research, to employ stimuli that resemble natural languages more closely than the letter or tone sequences commonly found, for example, in Artificial Grammar Learning (AGL) studies. The present experiment seeks to apply AGL methodology and awareness measurement techniques to the learning of natural language syntax.

Methods

21 adult native-speakers of English with no background in German (or any other V2-language) were recruited for this experiment. The average age of the participants (8 male, 14 female) was 21.5 years. A semi-artificial language, consisting of English words and German syntax, was used in this experiment. In generating the stimuli, English declarative sentences were rearranged in accordance to German verb placement rules as in (1-2):

(1) Over the past year PLAYED Jennifer many important parts in the school productions. (V2 in main clause)
(2) Yesterday LEARNED Chloe that the university her application ACCEPTED. (V2 in main clause, V-final in subordinate clause)

Training phase. Participants were exposed, under incidental learning conditions, to auditory input consisting of 256 sentences of the semi-artificial language. They were instructed to listen to 'scrambled sentences' in a meaning-oriented task. They had to judge, on an item-by-item basis, whether the statements made in the sentences were plausible or not. Only half of the presented sentences were plausible.

Testing phase. Participants were told that the scrambling of the previous 256 sentences had not been arbitrary but that a 'complex system' had determined the word-order of all items. They were then instructed to listen to 80 new scrambled sentences and to judge, on an item-by-item basis, whether they were generated in accordance to the above-mentioned system or not. In addition, participants were asked to indicate, after each grammaticality-judgment, how confident they were in their decisions on a binary confidence scale (high vs. low confidence). Only half of the

80 novel sentences were grammatical. With the exception of a few function words (determiners and prepositions), no lexical item was repeated from the training set, making the test analogous to the letter-set transfer paradigm in AGL research.

Results and Discussion

Participants' confidence ratings were analyzed using the binary confidence technique (Kunimoto et al., 2001; Tunney & Shanks, 2003). The analysis indicated that 13 participants were equally confident in correct and incorrect classifications, suggesting that they were not aware of the knowledge used in the grammaticality-judgment task (GJT). There was no correlation between confidence and accuracy ($r^2 = 0.0007$). The Zero-Correlation Criterion was thus met (Dienes et al., 1995). Average GJT performance was 51% and hence not significantly different from chance.

In the case of the remaining 8 participants, the analysis indicated that they tended to be more confident in correct decisions and less confident in incorrect ones, suggesting they had some awareness of the information they were relying on in the classification task. For this group there was a positive linear relationship between confidence and accuracy ($r^2 = 0.59$). The more confident participants were, the higher they tended to score on the GJT. Average GJT performance was 63%, which is significantly different from chance ($p < 0.01$).

In sum, the results of this experiment indicate that adults are able to acquire some of the regularities of German word-order after a relatively brief exposure period, while processing sentences for meaning and without having been explicitly instructed to do so. However, whatever learning took place in this experiment was explicit. Our continuing research explores whether there are conditions under which adults can implicitly acquire syntactic rules.

References

Dienes, Z., Altmann, G. T. M., Kwan, L., & Goode, A. (1995). Unconscious knowledge of artificial grammars is applied strategically. *Journal of Experimental Psychology: General, 21,* 1322-1338.

Kunimoto, C., Miller, J., & Pashler, H. (2001). Confidence and accuracy of near-threshold discrimination responses. *Consciousness & Cognition, 10,* 294-340.

Tunney, R. J., & Shanks, D. R. (2003). Subjective measures of awareness and implicit cognition. *Memory & Cognition, 31 (7)*, 1060-1071.