Past Tense Priming in an Auto-Associative Network

Mary L. Hare[1] and **William D. Marslen-Wilson**[2]
[1]Center for Research in Language, UC San Diego, La Jolla, CA 92093
hare@crl.ucsd.edu
[2]Dept. of Psychology, Birkbeck College, University of London
w.marslen-wilson@psychology.bbk.ac.uk

Introduction

In cross-modal priming experiments, we find that present tense verbs reliably prime their stems with no difference between regulars and irregulars. In the past tense, although there is still priming in both cases, the effect is smaller in the irregular verbs, and the difference between regular and irregular is significant. This difference in the ability of irregular past tense verbs to prime their stems might be taken as evidence for two mechanisms in the production of the past tense (cf. Prasada and Pinker, 1993; Prasada, Pinker and Snyder 1990).

We show that these results are less of a challenge to the uniform mechanism account than a superficial reading might indicate. We find that it is the difference in the extent to which the verbs of the data set share the regularities and subregularities of the inflectional system, and not any distinction in the mechanisms of representation and learning, that leads to differences in the stem-inflection relationships.

Priming in an Autoassociator

We model these results with an auto-associative network, in which the input and output are identical. This architecture, with a reduced number of hidden units, can force a network to extract generalizations about the data so that it will be most successful at reconstructing those patterns which most fully share in the subregularities of the data set. We trained the network on 900 regular and 100 irregular verbs. Frequency of presentation of the irregular verbs varied according to frequency of occurrence in the LOB corpus. The network was trained to produce both stem and past tense in response to stem and past tense as input, to produce the stem in response to the stem, and to produce the past tense in response to the past tense. There was no crossing of categories, however - the network was never trained to produce the stem in response to only the past tense, or the past tense only in response to the stem. This task was reserved because it will be used in the testing phase: We take it to be the equivalent, in the network, of the priming task.

In a test of stem/stem identity priming, the complete set of verb stems was presented to the network, and error was collected on the stem patterns on the output. Average error was computed for the regular and irregular verb classes. The results of the ID priming test showed no difference in error between the regular and the irregular verb stems. Since we assume a correlation between error in this task and priming in a lexical decision task, this result predicts that both regular and irregular verbs should show equivalent results in identity priming.

The network was then tested on the past tense/stem priming task. The average error was computed for the regular and irregular classes of verb stems. In this case, in contrast to the results in the ID priming task, there was a clear difference in the degree of error for regular and irregular verbs. Although for both verb classes the error in the past-tense/stem priming simulation is higher than in the ID priming task, error for the regular verbs is lower, at all points in training, than the error for the regular verbs. This parallels the experimental results, where priming was significantly lower with irregular past tense primes than when the past tense prime was a regular verb.

We discuss these results in reference to experimental results (Seidenberg and Bruck, 1990; Prasada, Pinker and Snyder 1990) suggesting that they are consistent with the behavior of a single mechanism sensitive to graded effects of frequency and consistency.

References

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