

## Grammar is both categorical and gradient

In this talk, I will show that humans can use their grammar to perform both categorical and gradient tasks. I will discuss results from two kinds of experiments to illustrate this: (i) word-likeness rating experiments where subjects have to rate individual non-words for their word-likeness, and (ii) comparative word-likeness experiments where subjects have to compare different non-words for their word-likeness.

Subjects reacted categorically in the word-likeness rating experiments, but gradually in the comparative word-likeness experiments. In word-likeness rating tasks, subjects rated all possible words equally good and all impossible words equally bad – they distinguished categorically between grammatical and ungrammatical. In the comparative word-likeness tasks, subjects were sometimes required to choose between two possible or two impossible words. They then made finer distinctions by selecting the token that is less marked according to the grammar of their language – they distinguished between degrees of grammaticality and ungrammaticality. What is particularly interesting is that the same two non-words can be treated differently in the two task conditions. In a word-likeness rating experiment, two (un)grammatical words are both rated equally. But when asked to choose between these non-words in a comparative word-likeness task, subjects show a preference for the more well-formed of the two.

I will discuss experiments performed by Berent and Shimron (1997) with Hebrew speakers, as well as experiments that I performed with English speakers. Berent and Shimron set out to test whether Hebrew speakers are sensitive to the distribution of identical consonants in verbal roots. Hebrew allows verbal roots with no identical consonants ([Q-S-M]) and with identical final consonants ([Q-S-S]), but not with identical initial consonants (\*[Q-Q-S]). Berent and Shimron presented Hebrew speakers with non-words of these three kinds in a word-likeness rating task. Subjects received one non-word at a time, and had to rate the non-words on a 5-point scale. Berent and Shimron found that the two kinds of possible non-words ([Q-S-M], [Q-S-S]) were rated equally well, and both better than the impossible non-words (\*[Q-Q-S]). They then presented the same tokens to their subjects in a comparative word-likeness task. Subjects were presented with a non-word of each kind and they had to order the three non-words in terms of their word-likeness. In this task, their subjects distinguished between the two kinds of possible words – non-words with no identical consonants ([Q-S-M]) were ordered before non-words with final identical consonants ([Q-S-S]). See (1) below for the results.

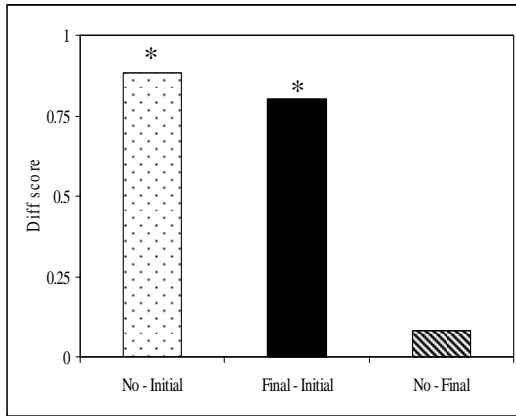
I conducted a similar set of experiments with English speakers. English allows words of the form [stVt] (*state*), but not of the form \*[spVp] or \*[skVk] (*\*spape*, *\*skake*) (Fudge 1969, Davis 1991). I presented subjects with non-words of the form [stVt], \*[skVk] and \*[spVp] in a word-likeness rating task, asking them to rate each non-word on a 5-point scale. Subjects rated the possible words ([stVt]) better than the two kinds of impossible words (\*[spVp], \*[skVk]), but did not distinguish between the impossible words (\*[spVp] and \*[skVk] were rated equally). However, when I presented subjects with the same kinds of non-words in a comparative word-likeness task, they did distinguish between \*[spVp] and \*[skVk] – when asked to select between these kinds of non-words, subjects preferred \*[skVk] over \*[spVp]. This corresponds to the fact that English is in general more tolerant of the co-occurrence of dorsals than labials (cf. *skunk*, *skulk* but *\*spump*, *\*spulp*). See (2) below for the results.

The word-likeness rating experiments show that language users can use their grammar to make a categorical distinction between grammatical and ungrammatical. But the comparative word-likeness experiments show that they can also make finer gradient distinctions between degrees of grammaticality (Hebrew) and ungrammaticality (English). We therefore need a model of grammar that can also do both of these. Generative grammars in general can easily make the categorical distinction between grammatical and ungrammatical – a grammatical form is a form for which a well-formed derivation is possible (i.e. there exists a possible input that the grammar will map onto the form). But the distinction between degrees of (un)grammaticality requires a grammar with strong comparative powers in addition to generative powers. I will show that an OT grammar is ideally suited for this precisely because OT is comparative by design – an OT grammar can compare two non-words for their relative well-formedness.

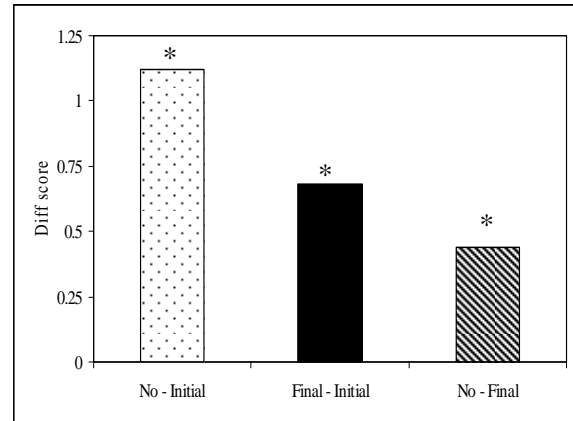
I will also discuss the general problems faced in using results from psycholinguistic experiments for phonological theory building. What can these data be used for and what can it not be used for, how can we control for variables other than grammar that can influence the results of the experiments, etc.

- (1) Berent and Shimron's (1997) results in terms of difference scores between non-word types (In the comparative word-likeness experiment, they assigned a value of 3 to the token rated best, 2 the token in the middle, and 1 to the token rated worst. Comparisons marked with \* differ significantly at  $p < 0.05$ .)

a. Word-likeness rating

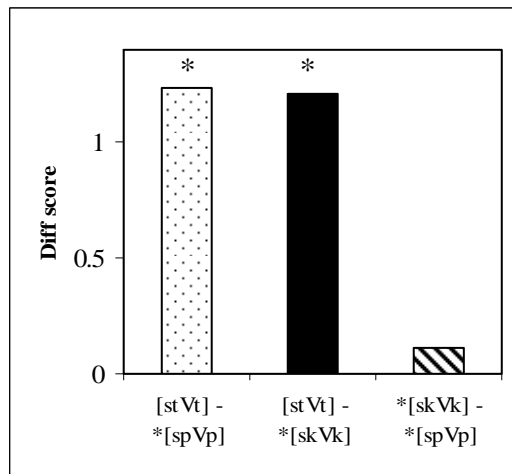


b. Comparative word-likeness

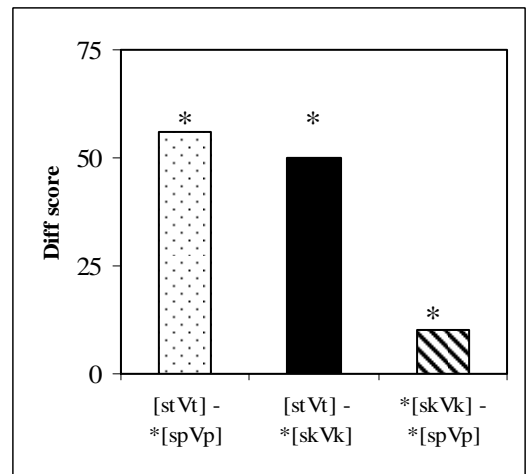


- (2) Results of the [sCVC]-experiments in terms of difference scores between non-word types (In word-likeness rating, the difference scores is the difference in the mean rating assigned to non-word types. In the comparative word-likeness experiment, the difference score is the difference in the percent times that each token type was selected as most word-like. Comparisons marked with \* differ significantly at  $p < 0.05$ .)

a. Word-likeness rating



b. Comparative word-likeness



## References

- Berent, Iris, and Shimron, Joseph. 1997. The representation of Hebrew words: evidence from the obligatory contour principle. *Cognition* 64:39-72.
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