

(Presented at CUNY Human Sentence Processing Conference, Poster Session, 17 March 1994.
Follow-up study, "A psycholinguistic investigation of syntactic satiation effects," is in preparation.)

A Psycholinguistic Investigation of Weak Crossover, Scope, and Syntactic Satiation Effects: Implications for Distinguishing Competence from Performance*

William Snyder

ABSTRACT

The classic psychometric of theoretical linguistics, the grammaticality judgement, is proving inadequate in a variety of contexts. Chomsky (MIT lectures, 1993) has proposed that certain types of island effects are the result of *processing* difficulties rather than syntactic violations, yet simple grammaticality judgements cannot distinguish the two. Additionally, isolated grammaticality judgements are inadequate for testing theoretical predictions about a *correlation* in grammaticality, across speakers, of two different constructions.

"*Syntactic satiation effects*," in which certain types of ungrammatical sentences receive increasingly higher grammaticality ratings over time, are examined as a possible diagnostic of "ungrammaticality" caused by processing difficulty. It is demonstrated that (1) satiation effects can be induced experimentally, (2) satiation effects are specific to certain sentence types (viz. classical subjacency violations), (3) satiation effects are *not* general to all points of cross-dialectal or cross-linguistic variation, and (4) satiation effects do appear to generalize beyond the particular lexical items with which they were induced.

A second line of work concerns the use of group data to evaluate predicted *correlations* in grammaticality judgements. A case study is presented, evaluating a predicted correlation between grammaticality ratings of weak crossover configurations, and grammaticality ratings for wide scope of a quantifier in corresponding sentences with two quantified NPs.

* The author was supported by an NSF research traineeship in linguistics and cognitive science at MIT, with additional support from the McDonnell-Pew Center for Cognitive Neuroscience at MIT. Many thanks to S. Avrutin, K. Broihier, N. Chomsky, S. Crain, A. Ferdinand, J. Ganger, T. Gibson, T. Harris, E. Kaan, C. Phillips, A. Matan, G. Mauner, T. Maxfield, P. Pica, S. Pinker, D. Poeppel, M. Potter, S. Powers, C. Schutze, A. Senghas, D. Smetters, C. Sorrentino, K. Stromswold, J. Tenenbaum, J. Thomas, K. Wexler, and colleagues in the MIT RTG program for helpful discussion and suggestions. Correspondence should be addressed to Snyder, MIT Room E10-104, 77 Massachusetts Ave., Cambridge, MA 02139. (E-mail: snyder@psyche.mit.edu)

Syntactic Satiation Effects for Islands

It is often reported anecdotally that over time, certain types of island violations that were initially judged ungrammatical begin to sound increasingly acceptable. This phenomenon is sometimes referred to as "linguists' disease," or as a "syntactic satiation effect." Many linguists admit that they are no longer sensitive to the (presumed) ungrammaticality of certain island violations, and that they have simply memorized the judgements that are standardly adopted in the linguistics literature.

Pursuing a line of inquiry initiated in unpublished work by Karin Stromswold (p.c.), this project will examine whether syntactic satiation effects can be induced and/or measured *experimentally*. Moreover, this project addresses several key questions concerning syntactic satiation effects: What is the *locus* of such effects (e.g., lexicon, parsing, syntactic knowledge)? How *general* are the effects (e.g., all sentences, specific sentence types, specific lexical items)? Is the susceptibility of an ungrammatical sentence-type to syntactic satiation effects related to a role of *processing limitations* in the judgement of ungrammaticality?

Method

- * Subjects (22 paid MIT undergraduates) were asked to provide a *yes/no* judgement of grammaticality for a series of (58) sentences, presented sequentially, one item per page, in a printed questionnaire.
- * Each item consisted of a "context" sentence, describing a particular situation, and then a "test" sentence, always in the form of a *wh*-question about the preceding situation. (Instructions were worded so as to avoid an "echo" interpretation of the questions.)
- * The questionnaire included (4) practice items, (50) experimental items, and a (4) item post-test. The experimental items were randomly arranged into five blocks, each containing (3) fully grammatical items and one each of (7) mildly-to-severely ungrammatical sentence types (Table 1).
- * Forward/backward order of presentation for the (50) experimental items was balanced across subjects.

* Syntactic satiation was measured for each sentence type by comparing each subject's number of *yes* responses in the first two blocks, to the number of *yes* responses in the last two blocks. A subject was said to have exhibited a "satiation effect" for a given sentence type, if the number of *yes* responses in the last two blocks exceeded the number in the first two blocks.

* Based on anecdotal discussion of "linguists' disease," *whether*-islands and complex NP effects were predicted to be subject to syntactic satiation. *That*-trace effects and left-branch effects were predicted not to be subject to satiation. No prediction was made concerning the remaining ungrammatical sentence types, which were included mainly as fillers and to provide a *range* of degrees of ungrammaticality.

Table 1. Ungrammatical Sentence Types

| | |
|---------------------------------|---|
| <u>Want-for</u> : | Who does John want for Mary to meet (t)? |
| <u>Subject Island</u> : | What does John know that a bottle of (t) fell on the floor? |
| <u>Whether Island</u> : | Who does John wonder whether Mary likes (t)? |
| <u>That-trace</u> : | Who does Mary think that (t) likes John? |
| <u>Complex NP Constraint</u> : | Who does Mary believe the claim that John likes (t)? |
| <u>Adjunct Island</u> : | Who did John talk with Mary after seeing (t)? |
| <u>Left Branch Constraint</u> : | How many did John buy (t) books? |

Results

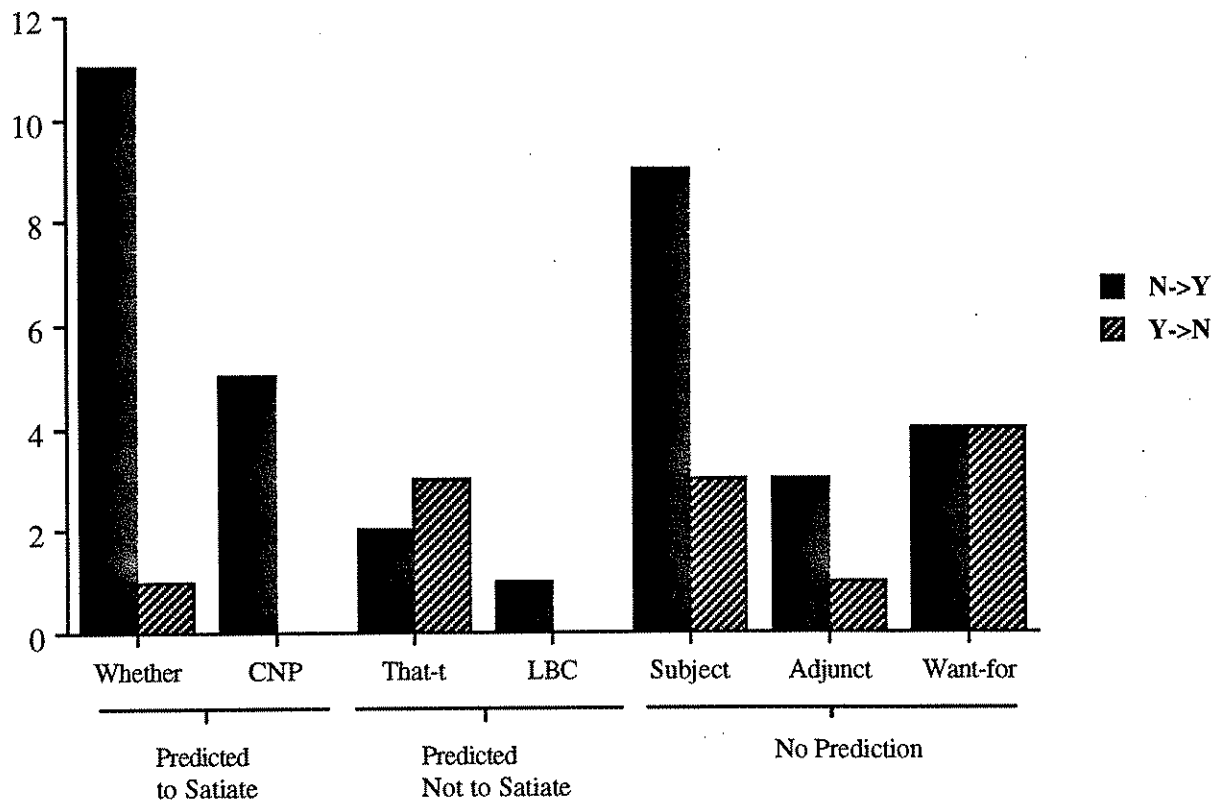
* Graph 1 compares, for each sentence type, the number of subjects who provided more *yes* responses at the end, versus the number of subjects who provided more *yes* responses at the beginning of the experiment. (Subjects who provided invariant responses, or a balanced number of *yes* responses at the beginning and at the end of the experiment, are excluded from Graph 1.)

* Satiation effects were obtained for *whether-islands* and for *complex NP* violations, as predicted. The preponderance of subjects with more *yes* responses at the end (satiation) is statistically significant by a binomial test: for *whether-islands* $p=.00317$; for *complex NP* $p=.0313$. This effect *cannot* be the result of differences in the test items at the beginning versus the end of the experiment, because forward and backward orders of presentation were each used for exactly half the subjects.

* Also as predicted, *no* satiation effect was obtained for *left-branch constraint* violations or for *that-trace* violations.

* Of the remaining ungrammatical sentence types, none showed a significant satiation effect, although a non-significant preponderance of "no-to-yes" response patterns for *subject islands* is suggestive.

Graph 1. Comparison of numbers of subjects with "No-to-Yes" versus "Yes-to-No" response patterns



Are Satiation Effects Lexically Specific?

The experimental items for *whether*-islands all used the matrix verb *wonder*. The experimental items for complex NP violations all used the phrase, "believe the claim." An important question is whether the observed satiation effects extend beyond these particular lexical items.

The four-item post-test at the end of the experiment included one *whether*-island item with the matrix verb *ask*, and one complex NP item using the phrase, "accept the idea." An analysis was performed on subjects who initially rejected *whether*-island items with *wonder*, to determine whether satiation with *wonder* led to an increased tendency to accept *whether*-islands with *ask*. A similar analysis was performed for complex NP violations. The results are summarized in [Table 2](#).

The results suggest that satiation effects for one lexical item *do* carry over to other lexical items, at least in the case of complex NP violations (Fisher Exact One-tailed $p=.0393$). The similar contingency for *whether* islands is suggestive but not statistically significant (Fisher Exact One-tailed $p=.137$).

A complication, however, is that subjects who fail to show a satiation effect on the experimental items often accept the corresponding item in the post-test. This suggests that the strength of island effects *in general* is sensitive to the choice of lexical items.

Table 2. Analyses of Lexical Specificity

| Complex NP Constraint: | | <i>...accept the idea that...</i> | |
|-------------------------------|--------------|-----------------------------------|--------|
| | | Reject | Accept |
| <i>...believe the</i> | No Satiation | 13 | 4 |
| <i>claim that...</i> | Satiation | 1 | 4 |
| Whether Islands: | | <i>...ask whether...</i> | |
| | | Reject | Accept |
| <i>...wonder</i> | No Satiation | 3 | 4 |
| <i>whether...</i> | Satiation | 1 | 10 |

Conclusions

- * Syntactic satiation effects can be *induced experimentally*.
- * The effects are *specific to certain sentence types*. They are not an "across-the-board" phenomenon affecting all sentence types equally. Hence, linguistic theory is properly held accountable for an explanation of *which* sentence types are and are not susceptible to satiation.
- * Limited evidence suggests that satiation effects induced with one set of lexical items do *carry over* to sentences constructed from *different lexical items*.
- * Given that *that*-trace effects and *want-for* effects are variable even across dialects of English, and left-branch effects are subject to cross-linguistic variation (Snyder, Wexler, & Das 1994), it does *not* appear that susceptibility to satiation corresponds closely to points of *cross-linguistic variation*.
- * A probable *locus* of satiation effects is in *sentence processing*. A tentative hypothesis is that certain types of island effects are due to the structure of working memory for filler-gap dependencies, and that satiation consists in the development of an alternative computational strategy for mapping fillers to gaps. *If this is correct, susceptibility to satiation effects may serve as an extremely useful diagnostic for contributions of processing limitations to the perception of ungrammaticality.*

Weak Crossover and Quantifier Scope

In many cases a syntactic theory predicts a significant *correlation* in the grammaticality of two distinct sentence types, across speakers. Such a correlation cannot be evaluated by any single informant, and thus calls for a more sophisticated psychometric than the standard, "isolated" grammaticality judgement.

A second line of work in this project is a case study in the use of *group* grammaticality judgements to evaluate the significance of a predicted correlation. Separate work by Pica & Snyder (1994) predicts a significant correlation, across speakers and across sentence types,

between the grammaticality of a weak crossover (WCO) configuration involving a quantified NP (1a,2a,3a), and the grammaticality of a wide-scope interpretation of the quantified NP (1b,2b,3b). In this part of the study, the prediction of Pica & Snyder is evaluated experimentally.

- (1) a. His mother likes every boy.
 b. Someone likes every boy. [*]
- (2) a. John gave its owner every paycheck.
 b. John gave someone every paycheck. [*]
- (3) a. John gave his paycheck to every workman.
 b. John gave something to every workman. [*]

[*On the relevant reading, *someone* or *something* does not necessarily denote the same person or object in every case.]

Method

* Subjects (14 volunteer MIT graduate students) were asked to provide a *numerical* rating of grammaticality for each of (6) test items. A rating of 9 implied full grammaticality, while a rating of 0 implied severe ungrammaticality. The endpoints of the scale were established in the instructions using example sentences. The test items were included at the end of a pilot version of the satiation study, and were intermixed with fillers.

* Each item consisted of a paraphrase of the intended meaning of the test sentence, followed by the test sentence and a scale on which to mark the rating.

* The experimental items were presented in groups of three to a page, in a printed questionnaire. *Subjects were instructed to ensure that the rating of a given item reflected both its "absolute" grammaticality and also its "relative grammaticality" as compared to the other two items on the same page.*

* One group of items included a weak crossover configuration involving a quantified NP as the lower object in each of three sentence types: monotransitive, double object dative, and *to*-dative (1a,2a,3a above). The other group of items included two quantified NPs in each of the same three sentence types (1b,2b,3b above). The paraphrase made it clear that in the intended reading the lower quantifier took wide scope.

* Notice that the use of a "grammaticality" rating for the relative acceptability of a specific scope reading differs from the implicit practice in much of the linguistics literature. For discussion, see Pica & Snyder (1994).

Results

* As predicted, the possibility of wide scope on the lower of two quantified NPs was positively correlated, at a statistically significant level, with the grammaticality of a corresponding weak crossover configuration ($r=.490$, $t(28)=8.83$, $p<.006$).

* At the same time, the grammaticality judgements appear to be very noisy. Perhaps as a result, the linear regression model accounts for only 24% of the variance.

Conclusions

* The use of numerical judgements of grammaticality solicited from a group of linguistically "naive" informants *can* provide a test of the *correlations* in grammaticality predicted by a particular linguistic theory.

* The combination of *absolute and relative* grammaticality in the rating method employed here substantially reduced the level of experimental noise obtained in earlier pilot work, where only *absolute* ratings of grammaticality were employed.

References

- Pica, P. and Snyder, W. (1994) "Weak crossover, scope, and agreement in a minimalist framework." To appear in *Proceedings of WCCFL XIII*.
- Snyder, W., Wexler, K., and Das, D. (1994) "Restrictions on quantity- and degree-type arguments in Japanese and Child English," To appear in *Proceedings of WCCFL XIII*.