

Non-categorical perception of a "categorical" rule

A. Krisjanis Karins

University of Pennsylvania

Naomi Nagy

University of New Hampshire

Department of Linguistics

619 Williams Hall

36th and Spruce Streets

University of Pennsylvania

Philadelphia, PA 19104

(215) 898-6046

kkarins@unagi.cis.upenn.edu

nagy@unagi.cis.upenn.edu

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Abstract

The notion of a "grammatical utterance" within linguistic practice is still commonly based upon the clearly non-experimental basis of gathering data through introspection. While this approach has perhaps been a necessary first step in developing linguistic theory, a social science must develop an objective means of gathering data. This paper develops a non-introspective experimental method to test the status of WH-traces in GB theory, providing an experimental basis for determining which sentences are and are not grammatical. The results of the experiment provide objective support for GB theory, but also suggest that the theory needs to be modified to account for the non-categorical nature of the data.

Acknowledgments

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The current solution is to take as input to grammar the intuitions of the theorist, free of any context. Originally, it was hoped that such judgments would be quite uniform, and that the major problems of variation would disappear into 'performance'. It now appears that intuitions are even more variable than behavior; but strangely enough, all such variations in intuitions are taken to be linguistically significant.

--William Labov (1972:77)

1. Introduction

In a recent paper, Bard, Robertson & Sorace (1996) suggest an improvement in the method of collecting grammaticality judgments for various syntactic structures. Instead of asking informants whether a sentence is acceptable or not, they propose a magnitude scale of response whereby informants rank the acceptability of sentences relative to one another. Thus, a given sentence is not marked as grammatical or ungrammatical, but is ranked as better or worse than any number of other stimuli sentences. While such a methodology greatly improves the precision with which grammaticality is measured, it unfortunately misses the more important consideration of whether the reported ranking is accurate.

Labov (1975) convincingly demonstrated that introspective judgments on grammaticality do not accurately reflect actual usage of language in the speech community. Thus, the methodological improvement suggested by Bard *et al.* does not break out of the established pattern of building theoretical models based upon introspective data. In order to improve the objective accuracy of grammaticality judgments, a methodology must be forged which does not rely upon intuition, but rather is grounded in empirical fact.

In building any theory, theoreticians must account for the general pattern first, and only then can they turn to the problematic cases commonly referred to as "exceptions." Thus, the often-cited claim by Chomsky (1965:3-4) that linguistic theory is

concerned primarily with an ideal speaker-listener in a completely homogeneous speech community, was a necessary first step towards building a coherent syntactic theory. However, Government-Binding (GB) theory (cf. Chomsky, 1981; Lasnik & Uriagereka, 1988), together with other branches of linguistics, has progressed quite far in the past 30 years, and the time is ripe to expand the experimental basis for linguistic theory, thereby bringing it in line with other social sciences.

To this end, we broaden the base of theoretically-motivated experimental research in the field of linguistics. The work reported here was conducted in order to test linguistic theory, but diverges from the majority of sociolinguistic research in that we present the results of a systematic experiment, rather than relying on observations of naturally-occurring speech. We have devised an experiment which tests perception, rather than production. We elicit reactions to an "ungrammatical" syntactic structure in order to test an element of syntactic theory.

We observe variation in this controlled environment, which highlights the need to utilize data in developing theoretical models of language. Our general aim is to show how experimental research can feed the development of linguistic theory as well as provide support for it. The specific point we address in this paper is the grammaticality of contraction over WH-traces.

2. Three approaches to the study of language

The broad areas of linguistic theory, quantitative sociolinguistics, and experimental linguistics (psycholinguistics) have been polarized, as indicated in Figure 1.

<Insert Figure 1 about here.>

This polarization is due to the fact that, for the most part, theoretical linguists base their work on intuition and do not consider the variation inherent to language, while quantitative sociolinguists often do not consider theories of linguistic structure, as they focus on empirical fact. This is particularly true in syntax, which is the area considered in this paper. Labov et al. (1972:268) summarized the situation as follows:

the possibility of gathering new data to resolve the issues [...] is often precluded by limiting in advance the kinds of data that will be considered relevant.

While psycholinguistic experimentation is intertwined with psychological theory, it does not have a broad impact on theoretical linguistics. That is, syntactic theory is not driven by experimental results. In contrast, recent developments in phonological theory (cf. Keating, 1988, 1991; Liberman & Pierrehumbert, 1984; Pierrehumbert, 1990; Pierrehumbert & Beckman, 1988) rely strongly on phonetic experimentation in developing phonological theory. Quantitative sociolinguistics does not usually involve strict experimental methodology, but rather is based on naturally occurring speech.

Recently, there have been efforts to close these rifts. In the following sections, we discuss each side of the triangle in Figure 1 in turn.

2.1. The theoretical - quantitative approach (axis a)

There are several works which exemplify the efforts by linguists to combine empirical observation of variable linguistic phenomena with theoretical prediction of linguistic patterns. Notable examples include Labov (1969), Guy (1991, 1992), Guy & Boberg (1994), Reynolds (1994), and Zubritskaya & Sheffer (1995). These linguists combine quantitative analysis with linguistic theory in two ways: Labov, Guy, and Boberg's works use quantitative analysis of elicited data to support theoretical predictions of linguistic models, while Reynolds, Zubritskaya, and Sheffer use the

variation inherent in language as evidence of the need to modify current theoretical models in order to account for real language data. We examine each of these in turn.

Labov (1969) uses quantitative data showing the frequency distribution of full, contracted and deleted copula forms as evidence of rule-ordering. Guy (1991, 1992) shows that the pattern of quantitative variation in final (t,d) deletion supports the Lexical Phonology (Kiparsky, 1982; Mohanon, 1986) claim that linguistic rules apply cyclically, by showing the exponential relationship between frequencies of final cluster simplification at 3 lexical levels. Guy & Boberg (1994) show that the variable process of final coronal stop deletion can be comprehensively treated as a consequence of the Obligatory Contour Principle. Reynolds (1994) extends Optimality Theory (Prince & Smolensky, 1993) to include Floating Constraints, which allows the theory to model the inherent variation in phonological processes such as English coronal stop deletion and Faetar final segment deletion. Zubritskaya & Sheffer (1995) highlight the need to expand Optimality Theory in order to account for gradient phenomena and propose how this might be done via parameterization.

2.2. Psychological - theoretical approaches (axis b)

In psychology, experimental work is designed to directly test particular aspects of psychological theory. However, there is only a small body of literature reporting psychological experimentation which relates directly to linguistic theory. One example is Johnson & Newport (1991), a thorough study showing that as one grows older, it becomes more difficult to acquire the syntactic structures of a second language. They demonstrate that the universal subjacency constraint is not different from language-specific phenomena with respect to language acquisition. What they fail to consider is that this may not be universal at all. They claim that

evidently, as age of learning increases, learners of a second language will sometimes violate the universal boundary set by the subadjacency principle and, by implication, internalize a grammar which allows structures thought to be unnatural to human languages (*ibid.* 254).

A second experiment is described by Lust, Eisele & Mazuka (1992), which discusses various experiments that provide evidence for Principle C of Binding Theory (Chomsky, 1981) from first language acquisition. They note that the evidence for Principle C is relative; that is, where one would (theoretically) expect complete blockage of coreference because of Principle C, one instead finds a statistically significant tendency towards blockage, but not complete blockage. Their explanation for this is that

behavioral research must assume that data derived from experimental tasks are modulated to some degree (at least chance) by performance factors (*ibid.* 340).

In a third study, Thornton (looking for citation) presents an elicitation task in which subjects produce sentences with WH-traces in them. In Thornton's "elicited production paradigm," experimenters give indirect questions to the subjects (who were children) and the subjects respond with direct questions. For example, a child is presented with the following stimulus:

- (1) "One of these guys gets to take a walk, one gets to take a nap, one gets to eat a cookie. So, ask Ratty who he wants."

The subject responds with (2).

- (2) "Who do you {want to / wanna} eat the cookie?"

In cases where the contracted form was produced, it indicated the ability to contract over a WH-trace (or indicated that WH-traces were not a part of the subject's grammar). Only 1 out of 19 children (4%) produced the contracted form in this scenario. Even assuming that the contracted form is grammatical, this result is not

surprising. The low percentage of contracted forms does not mean that the one produced is an error of any type. It may be due to the fact that it is hard, if not impossible, to elicit a particular variant of a variable which truly has free variation within a given context.

2.3. Experimental - quantitative approaches (axis c)

Syntactic theory, unlike phonological theory, is generally developed from intuitions about language, and not experimental findings. The "experimentation" consists of asking people, "Is X grammatical?" or "Can you say X?" Disagreement among responses is omnipresent, but the variation is never quantified or rigorously analyzed. Variation has traditionally been ignored within syntactic theory. Typically, "aberrant" data is classified as being from a different dialect (cf. Labov, 1972:77) or attributable to a performance error (cf. Chomsky, 1965:4).

This lack of an experimental basis for building syntactic theory is due to the difficulty in gathering tokens of a particular syntactic structure from natural speech corpora, due to their infrequent occurrence. It is difficult to elicit tokens of a particular syntactic structure, at least in comparison to the ease of eliciting particular phonological structures.

There is a weakness in the literature of linguistic theory: claims based on grammaticality judgments and introspection conducted by the theoreticians themselves are unreliable (cf. Newmeyer, 1983:48-72 for discussion).¹ Labov (1975) has convincingly demonstrated that introspective judgments on grammaticality made by theoreticians often lead to conclusions about grammaticality which are quite different from actual usage of language in the speech community.

2.4. Theoretical - quantitative - experimental approach

Each of the previous three sections describes work which combines two of the poles of linguistics, as demonstrated by the arrows (a) and (b) in Figure 2. In this paper, we go one step further, demonstrating how all three may be combined.

<Insert Figure 2 about here.>

We elicit behavior which exposes the structure that the informant assigned to the stimulus sentence, a direct reflection of the informant's grammar. Our findings indicate the necessity of re-examining the notion of grammaticality and demonstrate the need to investigate the potentially variable nature of syntactic rules.

We show that it is possible to use experimentation to address theoretical issues and to use quantified results from a large number of speakers, rather than intuitions from a small number of speakers, to determine grammaticality. The experiment described in the remainder of this paper demonstrates how an experiment may be used to obtain grammaticality judgments without reliance on intuition.

3. Case study of wanna-contraction

3.1. Theoretical background

In English, the behavior of WH-traces can be observed via the constraints on wanna-contraction. From a theoretical perspective, this phenomenon involves empty categories, such as PRO, which marks an empty subject, and t_i , the trace of an extracted

element. Consider the sentences (3) through (10), adapted from Chomsky (1981:180-182).

- | | |
|--|-------------------------------------|
| (3) They want [Bill to visit Paris] | (7) They want Bill to visit Paris |
| (4) They want [PRO to visit Paris] | (8) They wanna visit Paris |
| (5) Who _i do they want [[t _i] to visit Paris]? | (9) *Who do they wanna visit Paris? |
| (6) Who _i do they want [PRO to visit [t _i]]? | (10) Who do they wanna visit? |

As Chomsky (1981) indicates, sentences (7-10) are derived from sentences (3-6) via the rule given in (11):

- (11) want + to → wanna

However, it is clear that the rule of wanna-contraction shown in (11) is not applicable everywhere: sentence (9) is designated ungrammatical: native speakers of English generally believe that they would never say such a thing. Why is sentence (9) ungrammatical? Chomsky contends that WH-traces behave like lexical NP's, such as Bill. As shown in sentences (7) and (9), both lexical NP's and WH-traces block contraction. That is, WH-traces behave like proper names.

3.2. Motivation for investigation

Although this variable does not occur nearly as frequently as English (t,d), Spanish (s) and Portuguese nasalization, we have collected several incidents of "illicit" occurrences of contraction. These are reported in (12-17).

- (12) "You'll have to decide who you wanna lead this country."
 (13) "These are the people I wanna be there."
 (14) "Who do you wanna represent you?"
 (15) "What if you have a couple of columns you don't wanna be cut?"

- (16) "That's the type of mother you wanna visit more often." (the mother is the visitor)
- (17) "They'll pick the candidate they wanna win."²

These sentences provide evidence which demonstrate the possibility of contracting wanna over a WH-trace, which is contrary to the theoretical claim made in Chomsky (1981). The question for the linguist is: do such sentences represent a part of the grammar (competence) of these speakers, or are they simply "performance errors"?

3.3. Methodology

The most obvious way to determine the grammaticality of such sentences would seem to be a questionnaire. However, as Labov (1975) demonstrates, speakers' judgments of their own competence are rather unreliable. Thus, a straightforward questionnaire asking about the grammaticality of various sentences would not provide reliable results. Therefore, we developed a protocol in which informants reveal their "competence" without being aware that they are doing so. Our experiment developed out of a proposal by William Labov for such elicitations.

The method which we have developed to study speakers' competence is based upon the assumption that comprehension patterns with competence. If speakers cannot interpret a given structure, they then should not be able to produce it. We must also assume the converse, that if speakers interpret a sentence X to mean Y, then that interpretation of sentence X must be in their competence.³ The study does not rest upon whether a given utterance is grammatical, but in which of two possible ways a speaker interprets a native utterance.⁴

3.3.1. Stimulus

We proceeded in the following manner. First, speakers were presented orally with the story shown in (18).⁵

- (18) A mailman is walking down the street. He sees a big roll of money drop from an old lady's bag in front of him. The old lady doesn't realize what has happened. The mailman goes for the money. The old lady sees this, and goes for the money as well. They start struggling with each other. The old lady yells for help.
A policewoman and a big strong guy are standing nearby.

Then, one of the following questions was asked:

- (19) (i) Which one would you **want to** help?
(ii) Which one would you **wanna** help?

To either the question, the respondent had four possible responses:

- | (20) | <u>Response</u> | <u>Interpretation</u> |
|------|------------------------|-----------------------|
| | (a) the old lady | object |
| | (b) the mailman | object |
| | (c) the policewoman | subject |
| | (d) the big strong guy | subject |

We could determine that the listener had interpreted the trace as referring to the object of the verb "help" if they responded with either (a) the old lady or (b) the mailman. The syntactic analysis is illustrated in (21).

- (21) **Object** Which one_i do you want to help t_i ?
i.e., I want to help X (X=the old lady/ mailman)

anything to do with language or linguistics. For the data collected via questionnaire, the respondents were aware that language was at issue, but the rest of the questionnaire focused on vocabulary, so the focus of the question remained masked.

After the informants had answered the question about the story, they were then asked to introspect about the ambiguity of the question, and to comment if they thought the question was odd. Finally, they were asked to provide a biographical sketch of themselves including age, sex, and place of origin.

4. Results

Table 1 shows the responses of the informants according to which stimulus question they were presented with. The table reveals a statistically significant shift towards the object interpretation when want to is contracted to wanna ($\chi^2 = 20.01$, $p < .001$).

Because these numbers result from empirical observations of response behavior (answering a question) rather than from intuitive grammaticality judgments, we are confident of their accuracy. This is a primary benefit of linking theoretical and experimental research.

<Insert Table 1 about here.>

<Insert Table 2 about here.>

While the direction of this shift away from the subject interpretation in Table 1 qualitatively supports the prediction of GB syntax, there is a quantitative discrepancy. As shown in Table 2, GB theory would predict that there would be a 100% shift towards

object interpretation when the verb is contracted to wanna. Instead, we find only 65% of the responses making the predicted shift.

Exploring the social aspect of these data, we find no effects of typical social factors such as the speaker's sex, age, or region of origin. Several possible explanations for this present themselves.

First, our informant sample is rather homogeneous. 84 (71%) were college students at the University of Pennsylvania, mostly between the ages of 18 and 22, and 38 (32%) were from the New York/Pennsylvania/New Jersey metropolitan area. This accounts for the lack of stratification for social factors such as level of education, socioeconomic class, and age. However, there was a fairly even split between males and females (63 males and 55 females), but there was no correlation between sex and interpretation. That is, the ratio of object to subject interpretations is virtually identical for the males and females ($Z = -0.622$, not significant).

<Insert Table 3 about here.>

<Insert Table 4 about here.>

The lack of social stratification may also be due to a difference between perception and production. While a production variable is a powerful marker of social identity (people speak in a way similar to those around them), perception may not carry that load. People understand others who speak very differently: every speaker understands a wider range of variants than they produce. For example, Americans can generally understand English speakers from all parts of the country, although they can rarely accurately reproduce a non-native dialect.

5. Discussion

Our results provide evidence for the psychological reality of the non-phonetically realized WH-trace, as well as for the GB constraint on wanna-contraction over this trace. However, various questions are raised concerning the status of unpredicted results. Although when want to is contracted to wanna there is a significant change in interpretation based on a syntactic shift of subject-to-object extraction, there are nevertheless 35% of the subjects who still extract “illicitly” from subject position. How can we account for this rather high percentage of “ungrammatical” interpretations of our question?

Sociolinguists have long ago acknowledged that the "homogeneous speech community" with the "ideal speaker" does not exist. Our findings indicate that syntactic theory (as well as other fields of theoretical linguistics) must account for variation. Although this investigation provides strong evidence that GB theory is basically correct in its explanation of WH-traces and the constraint on wanna-contraction, there are nevertheless a fraction of responses which GB theory cannot account for and which need to be explained.

It has been proposed that variable rules (or variable representations) can account for the variable nature of phenomena like negative concord in English. (cf. Labov, 1972:48-57) That is, speakers have two possible structures to choose from, one in which negative attraction has taken place and the other where it has not. The fact that there is not 100% agreement with the posited grammatical constraint on wanna-contraction could, likewise, be a reflection of a choice between two existing rules. The two possibilities are: (i) WH-trace behaves like a lexical NP and blocks contraction, and (ii) WH-trace behaves like PRO in so far as it does not block contraction.

A second possible explanation of the responses is that there is a strong pragmatic skewing towards the subject interpretation which overrides syntactic constraints. The

informants might have thought that they did not hear the question correctly, and assumed an uncontracted form of the question. A problem with this explanation is that it cannot be empirically supported or refuted.

In order to strengthen the argument for the first explanation, future research must answer the following types of questions. Is it the same individuals who always get the “ungrammatical” subject reading, or does everyone get that reading 35% of the time? Given a larger and more diverse sample, could these percentages be predicted by a set of social factors? That is, do the percentages of response types relate to the probability of application of a syntactic rule? Finally, do all syntactic rules show this kind of variation, or is this rule peculiar, perhaps owing to the fact that it is implemented at the (low) level of phonetics, and not in (higher) morphological or syntactic structure?

6. Conclusion

In this paper, we unify three previously disparate branches of linguistic inquiry: theoretical, experimental, and quantitative. By collecting quantifiable observations of people's perception of a syntactic structure, we show how grammaticality judgments in syntax can be based on objective data. This is accomplished through the use of an experiment which provides data that are more readily comparable than typical sociolinguistic data which consist of observations of naturally-occurring speech. That is, by eliciting many responses to the same stimuli, we control for contextual factors that are always present in natural speech production data.

Linguistic theory should be built upon experimentation, and experiments should be designed with the goal of testing specific aspects of linguistic theory. By taking this

approach, linguistics as a field can become a true social science, which bases its theories upon observable facts and not on untestable intuitions.

ENDNOTES

¹ Newmeyer (1983) is in many ways a reaction against works that criticize the use of data obtained through introspection, such as Labov (1975). However, Newmeyer admits that experimental approaches can “...in principle be designed to give reliable results...[although] there does not exist at present an obvious replacement for introspective data” (ibid. 62-3).

² (12) is a statement made by President Bush speaking on October 13, 1992. (13) was reportedly uttered by a friend of Eugene Buckley. Anthony Kroch was asked sentence (14) by one of the investigators, and fully comprehended and answered the question. (15) was produced by Chris Cieri, February 23, 1993. (16) was produced by David Boas, September 19, 1993. (17) was produced by Stephanie Strassel, June 22, 1995.

³ This is potentially problematic, for it is clear that native speakers can often understand non-native speakers uttering ungrammatical sentences which a native speaker would never utter. However, in our experiment, everything uttered is within the grammar of native American English.

⁴ Of course, the best kind of experiment would elicit an utterance from the respondent. However, with wanna-contraction, this would be very difficult, if not impossible, since it is one of two phonetic variants that we wish to control.

⁵ This represents the fifth revision of the story. Based upon pilot tests with 5-10 subjects, we determined that the first four versions of the story proved to be pragmatically biased towards the object interpretation even without wanna contracted.

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TABLES

Table 1: Actual responses of all speakers

Question	Object interpretation (a)			Subject interpretation (b)		Total Number
want to	8	<u>20%</u>	<	32	<u>80%</u>	40
wanna	51	<u>65%</u>	>	27	<u>35%</u>	78
TOTAL	59	<u>50%</u>		59	<u>50%</u>	118

$$\chi^2 = 20.01, p < .001$$

Table 2: Predicted distribution of responses

Question	Object interpretation (a)			Subject interpretation (b)		Total Number
want to	8	<u>20%</u>	<	32	<u>80%</u>	40
wanna	78	<u>100%</u>	>>	0	<u>0%</u>	78
TOTAL	86	<u>73%</u>		32	<u>27%</u>	118

Table 3: Distribution of responses for MALE informants

Question	Object interpretation (a)			Subject interpretation (b)		Total Number
want to	1	<u>6%</u>	<	15	<u>93%</u>	16
wanna	31	<u>66%</u>	>	16	<u>34%</u>	47
TOTAL	32	<u>51%</u>		31	<u>49%</u>	63

$$\chi^2 = 14.72, p < .001$$

Table 4: Distribution of responses for FEMALE informants

Question	Object interpretation (a)			Subject interpretation (b)		Total Number
want to	7	<u>29%</u>	<	17	<u>71%</u>	24
wanna	20	<u>65%</u>	>	11	<u>35%</u>	31
TOTAL	27	<u>49%</u>		28	<u>51%</u>	55

$$\chi^2 = 5.42, p < .025$$

FIGURES

Figure 1

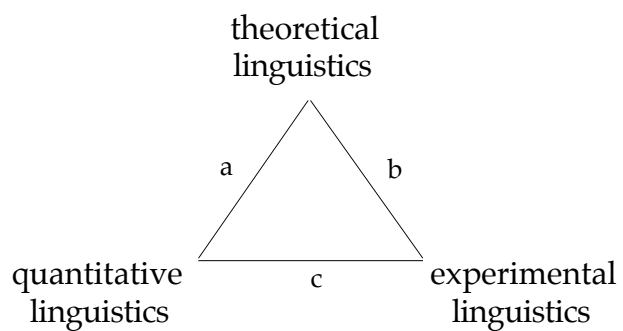


Figure 2

