

Intonation and stress, as subsets of phonology, are typically ignored in discussions of syntax. Chomsky and Halle, in *The Sound Pattern of English*, argue that once the English grammar has generated a phrase, the appropriate intonation follows automatically for the speaker, and thus stress is entirely subject to the syntactic structure of the sentence (qtd. in Schmerling 7). If this is true, stress should be entirely predictable for any possible phrase. In an essay on computational linguistics, Gerry Knowles and Lita Lawrence describe their efforts to create a program that will take written text as input, and produce a transcription that will include intonation. They argue “the assumption that one can account for English intonation by just sitting and thinking about it is not to be taken seriously. It is only by closely studying a corpus of natural data that one can...find algorithms [for intonation]” (Garside et al. 148) Like other computational linguists, Knowles and Lawrence believe that a computer need not be “artificially intelligent” to produce correct intonation transcriptions, so long as programmers have algorithms to work with. However, a perfect, or even near perfect, algorithm to model stress in English still seems to be elusive.

Clearly, if a speaking computer were ever to pass the Turing test, it would be essential that it could accurately imitate English stress patterns, yet there may be no algorithm refined enough for this purpose. This is because Chomsky is wrong with regards to stress; stress is *a part of* syntax, as opposed to simply a phonological feature applied after syntax generates a sentence. As a part of syntax, then, stress is contextual, and no syntax-based algorithm (which presumes that stress is a response to syntax) can possibly suffice to reproduce the patterns of sentence stress that occur in spoken English.

[Hmm. Not to be too picky, but just what does it mean for intonation to be “a part of syntax”? – and if it is part of syntax, then I’d expect it to be predictable by factors that are explicitly syntactic, like other parts of syntax. For example, whatever is responsible for a verb agreeing with its subject in person (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> person) and number is part of syntax, and can be correctly analyzed within the syntax (but not within the phonology or morphology). Then you go on to say stress is *contextual*, which sounds like it’s not “syntax”.]

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Here is an example to show that stress is a part of syntax. Last quarter, in a discussion of entailment, the question arose whether the phrase “I have two children” entailed the phrase “I do not have three children.” It is easy to imagine a scenario in which this entailment does not exist: suppose there were a government program for which a mother needed at least two children to qualify. The following dialogues, then, are possible, with primary stress indicated by an acute accent.

- Government Agent: I’m sorry, you need at least two children to qualify.  
(1) Mother: I háve two children. (In fact, I have thrée children.)
- Government Agent: Does anyone here have at least two children?  
(2) Mother: Í have two children. (In fact, I have thrée children.)

However, I cannot envision any situation in which Sentence (3) is possible, and the mother has any number of children other than two:

- (3) I have twó children. (In fact, I have thrée children.\*)  
[Nice – I agree with you.]

The only utterance that could prompt Sentence (3) would be a question of quantity, such as “How many children do you have?” or an erroneous tag question, such as “You have three children, don’t you?” Sentence (3) is also possible as a piece of

entirely unsolicited information, as is “I have two children.” In any of those cases, the “stress contour” of (3) precludes the possibility of three or more children, which is not the case with (1) or (2):

(1) I háve two children; (2) Í have two children → I have at least two children

(3) I have twó children → I have exactly two children

Sentences (1), (2), and (3) do not entail the same things, thus it would be incorrect to say that they have the same semantic interpretations. They also have demonstrably different phonological interpretations. However, a grammarian attempting to parse the three sentences would find that their syntactic or “deep” structures are equivalent. This is a challenge to the idea that from each “deep structure” stems [\[“stems”?\] a phonological interpretation and a semantic interpretation, since in this case, the phonological interpretation actually dictates the nature of the semantic interpretation. Therefore, to say that the stress contour of a sentence is the automatic product of rules relating to its syntax, as Chomsky does, is incorrect. Stress, if not completely inextricable from syntax, is at the very least an intermediary between the syntactic structure of a phrase and its semantic interpretation.](#)

Still, with regards to the example used above, it is possible to argue that a computer could be programmed to predict which word in the phrase should be stressed based on the phrase that preceded it, and also not to stress the quantifier unless the quantifier is precise. I only wanted to show as lucidly as I could that stress cannot be divorced from syntax in producing varying semantic interpretations, and so I used a simple example. However, there are other examples of stress choices English speakers

make on a regular basis that seem exceedingly difficult to incorporate into any program, inasmuch as they depend on overall context, not any recognizable structural features. My chief source for this paper was Susan Schmerling's Aspects of English Sentence Stress, which aims to establish rudimentary principles of stress outside of syntax-based algorithms. In particular, two of these rules seem so contextual as to render translation into programming impossible.

First is what Schmerling calls "a direct correlation between stress and pragmatic factors" (80). She states as her first principle that some items in a given utterance that ordinarily would be stressed may not be stressed in situations where the speaker might take them for granted, or find them insignificant (75). Obviously this is true in the case of repetitions, for example (with secondary stress indicated by a grave accent, and unstressed syllables indicated by a breve):

- (4) I bought the bréad.
- (5) A: Did you buy the bréad?  
B: Yès, I bóught the brëad.

In such a case, the direct object can certainly be "taken for granted," and the computer can be programmed to de-stress any repeated words. However, the same principle applies to less obvious situations. For example:

- (6) A: What happened to yóu?  
B: A mãn múgged me.
- (7) A: What happened to yóu?  
B: A dóg bĩt me.

The nature of the question *What happened?* makes it ambiguous whether to stress the predicate or its argument in the response, so English speakers must choose based on context and which one may be "taken for granted." In dialogue (6), it makes more sense

to stress the predicate, because encountering a man is so utterly unremarkable, and our cultural assumption about muggers is that they are men, anyway, so the verb “mug” already suggests the noun “man.” To put stress on *man* would sound unusual; it would sound like something Hippolyta might say to a fellow Amazon, both of them operating under the assumption that meeting men is somehow remarkable. On the other hand, in (7), *dog* is likely to take the stress, because in that instance the noun cannot be similarly “taken for granted.” However, if the speakers had some mutual expectation about dogs in the conversation, if they were both dog catchers, for example, then *dog* might well be de-stressed. This principle, therefore, requires a familiarity with context.

[Lovely example. Let's look at the other sentences too: (7C): A mán mǎgged me. – as you say, that suggests the Amazon interpretation; But with (7D) A dog bít me, that alternate stress pattern seems pretty much as good as your original. I completely agree with your global analysis of the situation, but what are the facts to be accounted for? It looks like the facts are 6B, 7B are good, 7D is pretty good, and 7C is not good in our world. Could it be that the factor involved is the relative information content (in some sense) of the two content words in each sentence? – that of the subject and the verb, one must get the nuclear stress, and it must not be the one with less “information content.” Hypothesis: use word frequency to measure information content – the higher the frequency of the word, the lower its information content. (in fact, it's usually quantified as  $-1 * \log \text{frequency}(\text{word})$ ]; ]

The other contextual principle which Schmerling discusses relates to what she calls “topic-comment cases.” While ordinarily the argument is stressed more heavily than its predicate, in topic-comment cases, the reverse is true. Schmerling defines “topic” as an NP that is “a kind of ‘old information’; it is something the speaker can assume to be, in a sense, on the addressee’s mind, or immediately inferable from the total context”

(94). “Comment”, then, would be some new information relating to the topic. A contemporary example of this case would be the following:

(8) Hussèin rejécted Bush’s ultimàtum to lèave.

In this case, it is unlikely that *Hussein* would receive primary stress if it were uttered today, because he has been in the news so much recently that he has become “old information.” Primary stress is given to the comment. On the other hand, consider this sentence, which might be uttered on a newscast:

(9) The Bolivian président rejected Bush’s invitàtion to dínner.

Since there is no comparable buzz about the Bolivian president, this is more or less a straight news sentence, and the normal rule that the argument receives greater stress than its predicate applies. There is sometimes ambiguity with this principle, as well, as evidenced in these two sentences.

(10) Todày I saw a mǒuse èating the cáke!

(11) Todày I saw a mǒuse éating the cáke!

Sentence (10) is a topic-comment sentence. The speaker’s primary concern is the fate of the cake, so *eating* is stressed above *mouse*. The addressee, then, would be expected to know, or at least to infer, that the speaker was already aware that he had a mouse problem. *Mouse* is “old information.” In Sentence (11), where the startling news is that there was a mouse at all, the addressee is not expected to know any such thing, and *mouse* receives primary stress. Again, this rule is entirely contextual; without knowing the assumptions of the speakers regarding Saddam Hussein and the mouse, it is impossible to know where to place the stress.

The conclusion that I draw from all this is, first, that the presumption that stress is predictable as an output of syntax is false, since the varying stress contour of a phrase can result in varying semantic interpretations. As such, stress should be seen as contributing to the deep structure of a phrase, not resulting from it. Therefore, algorithms based on syntax to model stress in English will never be reliable. Second, stress is often contextual, and so a program attempting to teach stress patterns to a non-AI computer will not be reliable, either.

#### WORKS CITED

Schmerling, Susan F. Aspects of English Sentence Stress. Austin: University of Texas, 1976.

Knowles, Gerry, and Lita Lawrence. "Automatic intonation assignment." The Computational Analysis of English. Eds. Roger Garside et al. New York: Longman, 1987. pp. 139-148

#### TA comments:

Good connection btwn stress and meaning. I would suggest you think of the two children examples as pragmatic rather than syntactic interactions w/ stress. (See Larry Horn on scalar implicatures - I can give you a ref if you're interested). In any case, you make the right observation that stress changes meaning and is often context dependant, not simply a reflex pattern laid over complete synt/semantic structures already generated. (See Levinson 2001 for a similar line of research.) Good job.