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A comparative analysis of English nuclear stress principles in conversation

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Abstract

Nuclear stress (or sentence stress) as a prosodic feature marks information flow in spoken English, and has received some treatment in the linguistics literature, most notably in pragmatics, but less so in newer phonological paradigms. Current theories in linguistics might shed light on this feature, such as Optimality Theory (OT) and cognitive grammar (CG). This paper compares potential insights and likely predictions of these two approaches for nuclear stress, by examining a recorded conversation of native US English speakers. The descriptive statistics indicate stress pattern distributions as expected, and some stress tokens show particular pragmatic and discourse functions of nuclear stress. The OT framework can better explain the interaction of different levels of prosody, grammar, and information structure, while CG might offer a more holistic explanation of stress, and its sociopragmatic and discourse functions, and may thus be likely more applicable to discourse studies, applied linguistics, and pedagogy. Implications are discussed for a CG theory of prosodic phonology, and for L2 pedagogy.

Key words

sentence stress, nuclear stress, Optimality Theory, cognitive grammar, phonology, pragmatics, discourse analysis

1. Introduction

In English utterances, one syllable bears an extra level of prosodic prominence over other lexical stresses, which signals the main communicative point or important information for interpretation of the utterance. Words that represent new and more important information are stressable, and tend to occur near the ends of clauses. This feature, known as sentence stress, tonic stress, nuclear accent, or discourse stress (Chomsky and Halle, 1968; Bardovi-Harlig, 1986; Lee, 2001; Selkirk, 1995; Gussenhoven, 2004), is a topic that has received only occasional treatment in the linguistics literature, as more research has focused on the complexities of lexical stress or general sentence intonation. This stress feature includes so-called neutral or normal stress for new information (usually on final new nouns in predicates), and special stress, i.e. contrastive or emphatic stress, which can fall on any lexeme.

Despite its function in managing discourse flow and topic flow, sentence stress has received little attention in discourse analysis studies, while it has received some attention in theoretical phonology and pragmatics studies. It is more often addressed in pedagogical materials for language teachers and students, mainly in terms of intonational prominence. However, linguistic studies and pedagogical materials tend to provide limited explanations and artificial examples. Some complexities are often

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omitted, such as stress for topic shifts, stress in compound nouns and complex noun phrases, and unstressed sentence-final items.

Applied linguistics and pedagogical materials tend to be informed by functionalist and pragmatics studies of nuclear stress, which constitute one of several approaches. Other possible approaches include older formal and generative studies, Optimality Theory (OT),[1] and more recently, cognitive grammar (CG). A small number of OT analyses of nuclear stress have been published, while a very limited amount of research exists on this in the CG framework thus far. Since these approaches remain unexplored (especially the CG framework), this paper attempts to explore the relevance and applicability of these approaches to nuclear stress, and to compare the possible insights of these approaches with an actual conversational sample. Such an approach can be relevant to applied linguistic studies of discourse, or for pedagogy and materials design for language learners and teachers. The research questions are as follows.

1. Can nuclear stress patterns in conversational data be better explained by a constraint-based approach or by cognitive grammar principles?
2. How are special stress patterns used in normal conversations?

After surveying the different stress principles and analytical approaches in the linguistics literature, a natural, recorded conversational sample of native US speakers is examined. Possible insights of the two main frameworks of interest, the OT and CG approaches, are compared in terms of how well they can explain the stress patterns in the data. Implications for theoretical and applied linguistics and pronunciation pedagogy are discussed, based on the descriptive data and insights from the following analysis. In various examples in this paper, nuclear stresses are indicated with a single underline on the stressed word or syllable.

2. Literature review

Sentence or nuclear stress has been known in the linguistics literature for many decades. This syllable will have greater length, amplitude and intonation than other stressed syllables in the sentence (e.g. the stressed syllable of *mo*vie in *Let's go see a movie*), with intonation or pitch as measured by fundamental frequency (F0) being the most important for identifying the nuclear stress or pitch prominence (e.g. Beckman and Ayers, 1997; Terkin and Hermes, 2000). For compound words, the nuclear stress aligns with the main compound stress, which is usually the first component of compound nouns (e.g. *mur*der mystery, *hard* drive, *sen*tence stress),[2] and for phrasal verbs, most often the verbal particle (*burn out*, *start over*).[3] Stress assignment depends on a discourse-level feature known as focus (e.g. Ladd, 1996; Erteschik-Shir, 1997; Gundel, 1999; Gussenhoven, 1999), or what is intended as the main point, or the most prominent or salient piece of information in an utterance, and this intended focus is most often a new content word near the end of a clause. In addition to this normal focus or neutral stress, contrastive or emphatic focus can highlight any lexeme in a sentence as needed or desired, including contents words (e.g. *I said finish your work now*) or function words (e.g. *I said put it in the box*).

2.1 Pragmatics accounts

[1] OT from its beginning was developed as a generative framework, in that it posits a universal set of constraints, and universal phonological mechanisms and principles, to account for the phonology of all languages, along with formal representations of constraints, constraint interactions, and constraint evaluations. Constraint interactions are used instead of derivations for monostratal and (generally, or as much as possible) non-derivational accounts of language; see, e.g. McCarthy (2002) and Odden (2014).

[2] Stress on the initial element of compounds is considered the default (see e.g. Liberman and Sproat, 1992; Giegerich, 2004); but see also Lee (2007) and Hirschberg (1993) for counter-examples and some complicating factors.

[3] For abbreviations, the last or most salient letter is usually the prosodic head (e.g. UN, FBI). However, the complexities of compound patterns and abbreviations are beyond the scope of this paper. See Celce-Murcia, Brinton and Goodwin (2010) and Yavaş (2011) for references and basic patterns.

Normal and contrastive stress patterns have been discussed within more formal pragmatics and semantics frameworks, but primarily in terms of focus and information structure, with occasional discussion of intonational realizations or phonological properties of stress. Such research has discussed, among others, factors that render referents focusable, or unfocused and unstressed, such as newness, givenness, and structures that induce special focus (e.g. phrases with *only* for special focus). Newness or givenness can depend on whether a referent was previously mentioned or can be presupposed, based on various contextual and semantic factors. Thus, referents can be focused upon first mention (among other conditions), and unstressed when mentioned again. Since phonology is rarely addressed in these studies, and much of this theoretical body of research is beyond the scope of this paper, the reader is simply referred to some of the many typical studies within this framework, such as theoretical accounts of focus and givenness (e.g. Rooth, 2008; Erteschik-Shir, 2007; Rochement, 2016), and at least one general theoretical discussion of the interface of focus and phonology (Kratzer and Selkirk, 2020).

More applied (or less formal) pragmatic and functionalist studies have examined nuclear stress (often referring to it as sentence stress) and prosody. Such accounts have particularly noted the tendency for content words (nouns, main verbs, adjectives, adverbs) bearing new information to be stressed, especially towards final clause boundaries. Many like Gussenhoven (1985, 1999) invoke focus as the explanatory pragmatic feature for stress placement, and many (e.g. Bardovi-Harlig, 1986; Cruttenden, 1986; Gussenhoven, 1999) have particularly attended to the distinction between the normal stress on new information, versus stress for contrast and emphasis, whereby speakers can put special emphasis on any word as required or desired in a given context. As a result, they have identified different patterns of contrastive or emphatic stress, namely, the following general categories: (1) direct or explicit contrasts, i.e. contrasts of explicitly mentioned items; (2) special emphasis; and (3) topic shifts. Explicit contrasts involve stress on an item to contrast it directly with an alternative (e.g. *Do you want red or blue? I want the blue one.*), including double contrasts (e.g. *I'll take the red pill, and you'll take the blue pill.).* This special emphasis or explicit contrasts can involve any kind of content word, function word (e.g. *I said put it in the box*), or even individual syllables or morphemes, (e.g. *I said exhale* implies *not inhale*). Stress can mark topic shifts in conversation and monologues, such as reshifts to previous topics, as indicated by discourse markers such as *as for*, *as to*, *speaking of*, *anyway* or shifts to new topics, as indicated by sentence-initial intonation rises (Wennerstrom, 1994, 1998) and/or transitional markers such as *now* (e.g. *Now for the topic at hand*). Some sentence structures also emphasize topics and propositions, namely, cleft structures (e.g. Miller, 1996). Focus particles (or focalizing adverbs, or focus markers, e.g. *too*, *even*, *also*, *especially*, *exactly*, *just*, *only*, *own*, *each*, *else*, *either*, *simply*, *merely*, *not only*) and emphatic pronouns (e.g. *She did it herself*) tend to convey contrast or emphasis, and are more likely to bear the main stress or modify a stress-marked word (König, 1991).

Pragmatic-functional studies have also identified some items that are not likely to be stressed. These include light, low-content, and inferable post-modifiers (Bardovi-Harlig, 1986; Chafe, 1994); parentheticals (Nespor and Vogel, 1986; Brinton, 2008); anaphoric nouns or synonyms (e.g., Kreidler, 1997); sentence-final discourse markers (Hansen, 1998); afterthoughts; and general temporal adverbials (which provide general context rather than new information). These items that are generally unstressed may be referred to as backgrounded expressions, which present minor information that is not new or informative, but rather contextually familiar or inferable; this can include distressed contents words, as seen in Table 1. These occur at the end of sentences after the primary focus and tonic stress. Examples are shown in Table 1, with the primary stress underlined, and backgrounded items in curly braces.

Table 1. Backgrounded expressions

Low content words	The sun {is shining}. I have a good book {to read}.
Final parentheticals	So it's all political, {you see}. We'll go to Tennessee—Nashville, {that is}.
Tag questions	You understand, {don't you}?
Politeness expressions	Could you loan me some money, {please}?
Discourse particles	I don't know, {though}.

General temporal adverbs	What are you <u>doing</u> {today}?

2.2 Generative accounts

In generative accounts, nuclear stress has been treated as far back as Chomsky and Halle's (1968) nuclear stress rule (NSR). This and most other generative or formal semantic accounts attempt to identify formulate and derivations that simply align stress with focus and syntactic constituents together (e.g. Selkirk, 1995; Kiss, 1998; Zubizarreta, 1998). However, these fail to adequately capture the roles of information structure (e.g. old, new, or background status), context, and speaker intention in focus placement. Some like Zubizarreta (1998) and Tajsner (2008) in the minimalist framework propose fairly complex and even unnatural derivations for stress placement, which lack empirical evidence for their proposals. A major shortcoming of derivational generative accounts, especially the more complex ones, is that they simply take the assigned focus as a given, and fail to consider or include context, speaker intentions, and communicative intent (Lee, 2013; Szwedek, 2017).[4] Due to the lack of empirical testing, they also miss important patterns and are thus unable to explain the primacy of sentence-final nouns in stress assignment (Szwedek, 2017). Thus, to understand the linguistic function of stress, reasons for special stress placement, or the communicative intent of stress, one must go beyond the generative accounts and turn to pragmatics for explanations.

Rather few Optimality Theory analyses of nuclear stress have been published. Costa (2001) provides a simple analysis for canonical sentences, involving a constraint that aligns stress with the main focus; this is essentially similar to the Nuclear Stress Rule and other generative proposals. Lee (2013) provides a more detailed OT analysis that attempts to explain the various linguistic domains involved: syntax, lexical classes, prosodic phonology, and focus as a specific feature within information structure. For normal stress, at least nine OT constraints are proposed to align prosodic stress, lexical stress, compound words, primary focus, content and function words, prosodic phrase constituents (namely, intonational phrases, or IPs), informational phrase domains, and syntactic boundaries. The most important constraint is NewFocus, whereby an utterance should have a focus, and other constraints align normal focus and stress toward the ends sentences and intonational phrases (Finality constraints). Several constraints align sentence stress on the focus and on existing lexical or compound stresses. Another constraint ensures that new content words are preferred, or otherwise new function words in short sentences with no new content (e.g. *What <u>is</u> it?*). A tenth constraint for special focus (contrast or emphasis) overrides all the others for realization of special stress. This analysis adequately accounts for the various linguistic domains and features involved, and seems to explain stress patterns very well in actual data.

With 10 constraints involved, this analysis seems rather complex, more so than previous formal or pragmatic analyses. The rationale for this complexity lies in an attempt to account for the interaction of different levels of grammar and linguistic factors involved: syntax, prosody (lexical, compound, and nuclear stress), focus (normal and special), and these interactions are handled by alignment constraints that align these differing levels and features (e.g. prosodic units, stresses, focus and sentences). This analysis also attempts to account for other stress effects that are often not discussed in previous theoretical analysis, such as function words with nuclear stress in shorter sentences (e.g. *What <u>is</u> it?*), and deaccented sentence-final items, not only informationally old items but final contextual, inferable, or backgrounded items (as in Table 1). Hence, the constraints and rankings were based on data discussed in the literature, for well-established linguistic structures and features. This complexity allows for a rather comprehensive account of all these factors – grammatical and prosodic structures, informational salience, and pragmatic factors. It may subjectively seem complex, but this is not an unmotivated degree of complexity, as it accounts for more than previous analyses. It seems unlikely to translate well into a system for linguistic analysis of discourse, a teachable pedagogical system for learners, or other applications. Yet the formalism of OT, including a more complex OT analysis such as this, is nonetheless appealing for the detailed view of interacting constraints. Also, this does lead to some predictive power, as will be explained in the Discussion section.

[4] As Bolinger (1972) famously pointed out, nuclear stress, especially with contrastive or emphatic stress, is difficult to predict. However, the goal of various linguistic analyses of nuclear stress in different frameworks is not necessarily a priori prediction of all stresses, but a posteriori explanation, for purposes of understanding the linguistic system, for explaining reasons for speakers' stress placement, or for providing guidance to language learners for using and comprehending stress usage.

Some constraint interactions are illustrated below. Two sample constraint evaluation tableaux are provided below, adapted from Lee (2013); the data and methodology of this paper are explained in the data analysis section below. The first shows the relevant constraints for a sentence with normal but non-final focus. The constraints include the following, ranked in the following order: Syntactic Integrity (not altering the syntactic form, e.g. to force the focused item to the very end); Align(SStress, Focus) to align the sentential or nuclear stress with the focus; Align-R(Focus, S) to right-align the focus with the sentence syntax; and Align(SStress, LexStress) to align the sentence stress with an existing lexical stress. In the example below (Table 2), the constraint Align-R(Focus, S) is minimally violated, since the focal item is not quite sentence-final, due to a final function word. The constraints are ranked in order from left to right. The output (*I think so*) best satisfies the constraints, while another option (*I think so*) would not be consistent with normal focal stress.

Table 2. Normal focus constraints

Output	Syntactic Integrity	Align(SStress, Focus)	Align-R(Focus, S)	Align(SStress, LexStress)
I think so.	✓	✓	(*)	✓
*I think so.	✓	*	✓	*

The second tableau (Table 3) shows an example of special focus, where the constraint Align(SStress, SpecFocus) aligns the nuclear stress with an item with intended special emphasis, which overrides the normal stress-focus alignment constraint Align(SStress, Focus); only the most relevant constraints are shown here.

Table 3. Special focus

Output	Align(SStress, SpecFocus)	Align(SStress, Focus)	Align-R(Focus, S)
It was exactly the same as the original.	✓	*	*

OT as a constraint-based system offers the advantage of explicating the complex interactions of different levels of structure and different levels of the grammar (i.e. different modules like phonology, syntax, and information structure). Like other generative accounts, the existing OT accounts of nuclear stress generally assume definitions of focus and givenness from theoretical and functionalist/applied pragmatics research. However, its approach to nuclear stress, at least those analyses published thus far, also tends to suffer from the same shortcomings of older generative analyses, in failing to deal with context, speaker intentions, and communicative intent. It is not necessarily the case that OT could not do so if properly extended. In fact, some linguists have attempted to incorporate pragmatics principles as constraints in OT (e.g. Blutner et al., 2004), just as some have attempted to extend OT to syntax (e.g. Bresnan, 2000). However, for all this to work more coherently and organically (at least for features like nuclear stress), the entire OT paradigm may need to be reworked so that the theory can readily incorporate phonology, syntax and pragmatics without becoming too unwieldy or unnatural.[5] Unless and until an enhanced OT can be developed, allowing for a clearer pragmatics analysis of nuclear stress and discourse features, the existing OT proposals will be assumed as representative analyses of stress and evaluated below.

[5] One problem to address, for example, is the sheer number of possible interactions possible between syntax, prosodic phonology, segmental phonology, morphology, and pragmatics constraints. Challenges would arise in delineating the relationship between these different language modules and limiting the interactions between constraints of these modules, so that arbitrary, unnatural, and unattested constraint interactions do not occur between all these modules. Another challenge would be in developing well-grounded and well-formed constraints that handle speaker intentions or discourse functions, in a manner consistent with OT principles for constraint formulation.

2.3 Cognitive grammar framework

Cognitive grammar analyses of nuclear stress as a whole seem lacking in the linguistics literature, though a few researchers have discussed certain relevant aspects. Szwedek (2017) cites various studies showing that 60-90% of English sentence stresses fall on sentence-final or near-final nouns, since indefinite and discourse-new nouns are aligned toward the sentence terminus, due to the general old-new information pattern of sentences. This is also because nouns represent distinct discourse entities or sentence objects, and tend to be more semantically concrete than verbs (Szwedek, 2011). Nouns are also syntactically independent, e.g. they can be used without verbs, and can be described syntactically apart from verbs, while verbs require nouns (e.g. noun arguments) in their syntactic descriptions, or for their use in sentences (Szwedek, 2011). Thus, as Szwedek argues, nouns naturally attract cognitive attention and focus, and are more salient for stress assignment than other lexical categories (Szwedek, 1987, 2011).

A CG approach to phonology posits that phonemes represent stored generalizations of instances of sound patterns in the minds of language users (Nathan, 2008), and so phonemes and phonological structures can be treated as grammatical forms in the CG framework. In standard CG, a grammatical structure or form is associated with a core meaning. The core form-meaning mapping can be extended semantically in new contexts for derived meanings or functions. Since CG treats grammatical forms and structures as meaning-bearing schemas or frames, the function of one form can sometimes be extended for new but related functions, meanings or nuances. This offers some possibilities for nuclear stress. For example, Välimaa-Blum (2004) discusses intonation as part of such a constructional frame, but mainly for unstressed anaphors and for emphatic or contrastive stress, as in the following famous pragmatics example.

(1) John$_{(i)}$ called Sam$_{(j)}$ a Republican and then <u>he</u>$_{(j)}$ insulted <u>him</u>$_{(i)}$. (p. 44)

The emphatic stresses indicates that contrary to normal expectations, *he* refers to Sam rather than John, *him* refers to John rather than Sam, and *insulted* is implicitly coreferential with *calling someone a Republican*.

In a cognitive or functional approach, a sentence with normal stress functions as a canonical sentence that adds new information according to standard old-new information flow (Szwedek, 2011, 2017). For example, the stressed noun in (2a) indicates that the noun complement *idiot* is a new item to the discourse, and while coreferential with the previous noun, it is new rather than old information. Deviations from this pattern signal different types of information flow, namely, contrast and emphasis, as in (2b).

(2) a. Zoe called Fritz an <u>idiot</u>.
b. Zoe called <u>Fritz</u> an idiot. (i.e. in contrast to someone else)

A CG approach to nuclear stress can then be sketched out here, whereby normal nuclear stress on content words represents a general default pattern. This is due to the general semantic salience of content words, and especially for nouns, particularly when they encode discourse-new information (Chafe, 1994; Szwedek, 2017). The mapping of a nuclear stress, focal item and sentence constitutes a constructional frame, or a meaning-bearing structure (cf. Goldberg, 1995). Since structures themselves can convey meaning in CG, if such an intonation pattern is regarded as a grammatical frame, then in a CG framework, we can thus characterize the communicative meaning and function of nuclear stress in sentences and discourse. We can posit (following Szwedek) that a sentence with normal stress functions as a canonical sentence that adds new information according to standard old-new information flow. Non-final normal stress may tend to occur in longer or slightly more complex sentences (e.g. with a discourse-given item as a syntactic element after the focus), which can signal a slightly more complex informational contribution to the discourse. Slight deviations might occur, for example, when a function word must be stressed due to a lack of content words (e.g. *This is <u>it</u>*), signalling a slightly lighter contribution (informationally) to the discourse. Normal sentence intonation patterns are also used to signal turn-taking ends (Hauser and Fowler, 1992), and sentences with similar rhythm patterns also invite or signal social cooperation in discourse (Polyanskaya, Samuel and Ordin, 2019), i.e. socially cooperative exchange of information in discourse, such as when interlocutors cooperatively build off one another's utterances in conversation. In a CG framework, these functions of sentence intonation can

be viewed as an extension of the general function of normal information flow that is signalled by normal stress. Interlocutors may often use utterances with normal stress, for sentences with similar informational and intonational patterns, for normal, amicable conversation that is based on a give-and-take of simple information exchange and building off each other's utterances. To some degree, this hypothesis is attested in the data set below (though more empirical verification will be needed in future research).

Special or emphatic stress represents a related and distinctive pattern, with stress on an item in a manner often contrary to the normal stress pattern. Such specialized uses of stress represent an extension or deviation from the basic normal stress pattern; i.e. the normal use of intonational prominence, the basic grammatical-semantic pattern, is modified and extended to derive a new discourse function. For example, the basic function of emphatic stress is for simple emphasis or clarification (e.g. *Get out of there now*), but can be extended for anaphor identification as in (2b) above, and this can be further extended for more specialized uses like topic shifts (as shown below). That is, special stress interrupts normal discourse flow to signal special emphasis, clarification, topic shift, or other functions.

Such extensions and modifications are organic to the CG framework. Though it lacks the formalism of the OT framework, the CG framework may be more adept at describing some aspects of the interaction of prosodic phonology, information structure, and discourse pragmatics. After examining a data set below, more will be said about a CG theory of prosodic phonology in section 4.3.

2.4 Applicable systems

For applied linguistics purposes, such as pragmatics analysis, discourse analysis, and pedagogical purposes, the OT constraint model can be simplified here. The more important constraints can be used by reformulating them to refer to stress alone rather than focus, and those for newness and word class can be combined. These constraints can be taught as general stress principles or as stress rules. The simplified system is shown in Table 4; these are ranked in the order in which they appear, though for our purposes here, it need not be applied as a full hierarchy. The compound stress and background constraints can generally be omitted when considering sentences without such structures, and dealt with as the need arises.

Table 4. Constraint-based principles

Abbreviation	Rule or principle
CE	stress on contrastive or emphatic item
New	stress on final new word
CpdStress	stress matches normal compound stress
LCW	stress on last new content word
LFW	stress on last new function word
–BG	(Final) backgrounded items are unstressed

In a CG framework, the following principles might be postulated. Normal stress on final content words is the general pattern, and its placement on non-final items or elsewhere can be considered variants of the normal pattern. Special stress represents a different pattern that is distinctive from normal stress. When it overrides normal stress, its presence is more auditorially noticeable and thus useful for special communicative intentions. Emphasis on one word calls attention to an important piece of information, and other uses derived from this basic pattern direct listeners' attention to more specialized functions, like double contrasts and topic shifts. Possible basic and derived patterns are listed in Table 5.

Table 5. Cognitive grammar patterns

Pattern name	Pattern	Function / meaning
1. Normal	Stress on final content word	Normal information flow
1a. Normal NF	Stress on non-final content word	Normal flow, final anaphoric or minor information
1b. Normal FW	Stress on final (final new) function word (if no new content words are present)	Normal flow, but informationally minor contribution
1c. Normal cpd	Stress on prosodic head of compounds	Marking compounds (including phrasal verbs)
2. Special stress	Special stress on any item	Emphasis: directing attention to important words or ideas, apart from normal flow
2a. Contrast	Special stress on contrasted items	Marking contrast
2b. Contrast-shift	Special stress on new topic	Topic shift

The Normal pattern is the general default pattern for English and other languages. Normal NF (non-final) extends this to sentences with final anaphoric nouns and backgrounded items, and Normal FW extends this to sentences with no content words. The Special stress pattern is a non-default pattern for calling listeners' attention to an item outside the normal new information flow; Contrast highlights a contrast between two items, and topic shifts can be accomplished with a non-default stress on a new item, especially sentence-initially. The next section shows the different stress patterns with frequency counts in a conversational data set.

3. Data analysis

The following conversational data set comes from a recording of a Midwestern American family's dinnertime conversations in their home[6] (from Lee, 2013). The recording was made discreetly (with the researcher out of view, and a camera and microphone placed inconspicuously near their dinner table). A segment of 5.5 minutes was transcribed and annotated by the researcher (a native English speaker and trained phonologist). Nuclear stresses and special (emphatic) stress patterns were marked for each utterance or sentence based on standard criteria of acoustic prominence for stress: pitch and/or fundamental frequency (F0), amplitude, and duration, relative to other syllables. When necessary, F0 or pitch patterns were checked in acoustics software, and all notations were checked and confirmed by another native English-speaking phonologist. Stress realizations were classified as special or emphatic when they, as the most prominent stress in an utterance, did not fall on the last new content word or last new item (when it should otherwise occur there, according to the expected new content word or final new pattern). Occasionally, a more prominent stress on a final content word was identified as emphatic rather than normal stress, when it exhibited greater acoustic prominence than a normal nuclear stress (that is, when the degree of intonational prominence and amplitude was higher than normal for that speaker for a normal focused lexeme, particularly with a greater degree of emotion), and when in the context it was clearly used for such emphatic or contrastive intent, and thus, for pragmatic purposes such as affective emphasis or contrast (including hyperbole, clarification, correction, topic shifts). Thus, both objective acoustic criteria and evaluation of contextual pragmatic intent guided the data transcription. Sections of the data are excerpted below for the relevant OT-based constraints and CG patterns (constraints not listed in a given cell are assumed to be irrelevant or inapplicable). Descriptive data are first provided, followed by an excerpt below. The conversation was transcribed, the stresses were marked and analysed by the author, and confirmed by another phonologist (both are native English speakers).[7]

[6] The family consists of the following speakers (Sp): a father (M), mother (G), a college-age daughter (K), a high-school-age daughter (L), and a male preschooler (P). The family is a white middle-class family in a medium-sized city in Illinois, and the parents are college educated. The family speaks in a white urban Midwestern variety of English that would readily pass for standard North American English.

[7] Nuclear stresses were marked, but not specific intonational patterns (e.g. rising or falling tones) for most tokens of pitch accents in the recording; this would be beyond the scope of the current study, but it will need to be analysed in future research. The two judges were native English speakers (including the author) from the Midwest, and speakers of standard North American English. The judges assessed stress accents based on intonational F0

3.1 Descriptive results

The data set contains 161 lines, with 132 analysable utterances with 133 stresses; each line contains a single utterance.[8] The descriptive statistics are generally consistent with previous studies. Among the content words, very few stressed adjectives or adverbs occurred; stressed nouns were by far the most common grammatical category. Of the 133 instances of sentence stress, 72% of tokens are normal new information stresses, while 28% were emphatic stresses. About 85% of the stressed words are content words, and 15% are function words. Of the content words, 69% bear normal stress, and 16% bear special stress; a few function words (3%) bear new information stress, while more function words (12%) bear contrastive stress. Table 6 summarizes stress tokens by lexical categories; percentages are for frequencies out of the total number of stress tokens.

Table 6. Totals for all grammatical categories

Categories	Normal stress		Special stress		Total tokens	
Nouns, total	61	(45.9%)	8	(6.0%)	69	(51.9%)
Monomorphemic noun	34		5		39	
Compound noun	27		3		30	
Verb (lexical), total	21	(15.8)	5	(3.8%)	26	(19.5%)
Main inflected verb	17		4		21	
Phrasal verb particle	2		1		3	
Infinitive	2				2	
Adjective	9	(6.8%)	6	(4.5%)	15	(11.3%)
Adverb	1	(0.8%)	2	(1.5%)	3	(2.3%)
Content words, total	92	(69.2%)	21	(15.8%)	113	(85.0%)
Non-lexical verbs, total	3	(2.3%)	2	(1.5%)	5	(3.8%)
Copula (be)	2		1		3	
Auxiliary	1		1		2	
Deictics, total	1	(0.8%)	10	(7.5%)	11	(8.3%)
Personal pronoun			3		3	
Interrogative pronoun	1		1		2	
Demonstrative pronoun			4		4	
Demonstrative adjective			1		1	
Locative pro-form			1		1	
Conjunctive adverb			1	(0.8%)	1	(0.8%)
Preposition			1	(0.8%)	1	(0.8%)
Quantifier			2	(1.5%)	2	(1.5%)
Function words, total	4	(3.0%)	16	(12.0%)	20	(15.0%)
Stressed lexemes, total	96	(72.2%)	37	(27.8%)	133	

Stresses were found with the following clause types. A full main syntactic clause alone was the most common pattern (52%). Others included a few instances of a relative clause, complement clause, or subordinate clause (11%); about 38% of utterances were incomplete sentences, including 7% with stressed predicates, and 31% interrupted or incomplete sentences that were too short to have a tonic stress. Table 7 compares final and non-final stresses by general lexical categories, i.e. final items refer

prominence, using commonly available acoustic or waveform software to reach 100% agreement on the stress accents.

[8] Each utterance is delimited by a boundary intonation; 29 utterances had no stresses, as they consisted of single unstressed words (interjections or discourse particles), incomplete or interrupted utterances, or unclear utterances with no stresses. Discourse particles (e.g. *yeah*, *oh*) are extrasyntactic and extraprosodic lexemes (outside the normal sentence syntax and propositional content) (Hansen, 1998). One sentence had a double contrastive stress.

to stressed content words as the final word of utterances, while non-final items would include utterances with a final anaphoric word or parenthetical phrase.

Table 7. Stress position

Category	Final		Non-final		Total	
Noun	57	(42.9%)	12	(9.0%)	69	(51.9%)
Verb (lexical)	11	(8.3%)	15	(11.3%)	26	(19.5%)
Adjective	5	(3.8%)	10	(7.5%)	15	(11.3%)
Adverb	2	(1.5%)	1	(0.8%)	3	(2.3%)
Content words, total	75	(56.4%)	38	(28.6%)	113	(85.0%)
Function words	3	(2.3%)	17	(12.8%)	20	(15.0%)

Instances of sentence-final backgrounded items totalled 14 tokens in 13 utterances, or 9% of utterances. Half of these (7) were general temporal expressions (*before*, *last night*, *tonight*, *today*, e.g. *tonight* at the end of line 3). Four were parenthetical expressions (29%): two vocatives, a politeness function (e.g. *please*) and a discourse functional expression (e.g. *remember?*). The other backgrounded items were two low-content nouns (14.3%) and one indefinite pronoun (7.1%). One can see final old items at the very end (e.g. line 21: *It's got Paul Newman in it),* as the syntax requires these phrases at the end, pushing the stressed new item to pre-final position.

The default normal stress is, not surprisingly, the predominant pattern in over 70% of utterances. Stress on final or near-final content words was most common, with new content words stressed in almost 70% of utterances, and new function words in only a few instances. In this particular conversation, the stressed new nouns were almost evenly divided between simple nouns and compound nouns, though this may vary depending on conversational topics. Contrastive stresses occurred in almost 30% of utterances, split almost evenly between contrasted content words (about 16%) and contrasted function words (about 13%). Main clauses were the predominant pattern, followed by incomplete sentences (consisting of only simple noun phrases, incomplete verb phrases with no predicate, or prepositional phrases). These results are consistent with older studies of new and special stress. Brown and Yule (1985) reported that 87% of stresses were for normal new information and 13% for contrast; Lehman (1977) found that 23.5% of stresses involved contrast or topic management. Chafe's (1994) study of contrastive stresses reported that 60% of contrasted items were previously mentioned (old or topical), 30% were inferable from the context, and 10% were new to the discourse.

Among the special stresses, some overt pairwise contrasts were used, either within turns or across speaker turns. Several contrastive stresses marked apparent topic shifts, and one focus marker (*exactly*) bore stress itself. Special emphasis was used with deictic forms (namely, *that*) or repetition, e.g. for clarification, plus two cases of hyperbole (e.g. *a billion times*). Altogether, 38 special stresses occurred in 37 utterances (28% of the utterances), with the following subtypes: special or intentional emphasis (12 instances); pairwise contrast (7); noun topic contrasts (7); emphatic repetition (6); and special emphasis on deictic pronouns (5) or a focus marker (1). These include specific pragmatic and sociopragmatic functions like topic shifts, correction, contradiction, and communication repair, as shown in Table 8 (the conversation mainly concerns Hitchcock films). This includes a friendly but potentially face-threatening contradiction (line 6), or correcting a child (line 137). In this conversation with four regular interlocutors, special stresses occurred on average every 4.6 speaking turns (median: 3 turns; range: 0–14 turns). Some examples are shown in Table 8 (with stresses underlined, and special stresses underlined and in boldface).

Table 8. Special focus examples

Example	Line#	Speaker	Utterances	Function
	5.	M.	Ya know I'm not a real Hitchcock fan	
(1)	6.	F.	I think Hitchcock movies are **great**	Contradiction
	10.	F.	any of the Vienn- Vienna after the war.	
	11.		I'm sure we'd recognize St. Stephan's.	
(2)	12.	A.	**You'd** like to work there once.	Emphasis
	17.	A.	Out at Stephansdom?	
	18.	F.	Yeh.	
	19.	B.	It's just a weapon.	
(3)	20.	A.	The **Rise** is a good Hitchcock movie	Topic shift
	21.		It's got Paul Newman in it.	
	22.		You'd love to watch it	
	23.	F.	What is it?	
(4)	24.	A.	It's The **Rise**	Clarification
(5)	57.	F.	The **other** one that I haven't seen	Topic shift
	58.		is Rear Window,	
(6)	59.		It's got Jimmy Stewart	
	60.		who's a **good** guy	Pairwise contrast ("good – bad")
	61.		and Raymond Burr's a **bad** guy,	
(7)	134.	T.	I wanna see- I wanna see Darth **Vader**.	Emphasis, Emotive expression
(8)	135.		I wanna see Darth **Vader**.	Emphasis, Emotive expression
(9)	136.	A.	Ya wanna see Darth **Vader**?	Repetition, Emotive expression
(10)	137.		You've **seen** Darth Vader {before}.	Emphasis, Correction

The results naturally show a preponderance of nuclear stresses on near-final or final content words, particularly on nouns, as would be expected. In an OT framework, this could be explained by the alignment constraints that favour such a distribution. In the functionalist and CG frameworks, this would be explained by the greater semantic salience of such content words and near-final words (Chafe, 1994; Szwedek, 2011, 2017).

3.2 Sample excerpt

A longer excerpt is shown in Table 9 below, where the speakers begin discussing Hitchcock films, and the full data set is shown in the Appendix.[9] Since New is the default constraint, it is not necessary to mark it explicitly; stresses designated with New, LCW, LFW and CpdStress in OT would generally correspond to the Normal principle in CG. Generally, the higher ranked OT constraints (CE, New, LCW) had a greater effect on how utterances were stressed, while lower constraints have less influence. As this excerpt attests, these few CG principles or OT constraints can account for most or all stress patterns in the conversation. The OT analysis adopted here treats Contrast as the more general category for special stress (Lee, 2013), while the CG approach here prefers Special as the more general designation. Otherwise, the relevant OT constraints and CG principles generally seem similar, and often one may seem like a notational variant of the other, and seemingly without offering any advantages over the other.

[9] Contrastive stresses are labelled according to whether the stressed item is a function word [FW] or content word [CW]. With the CpdStress constraint, the lexical category is generally not marked, unless a phrasal verb particle [FW] is stressed as the prosodic head; proper names and titles are also considered compound nouns. Unanalysable utterances are marked with a null symbol (Ø); backgrounded items are marked in curly brackets {}, and sentence stresses are underlined.

However, they differ in the additional insights and questions that are possible beyond the notations, and certain patterns in the data might be better explained by one approach, as discussed below. The conversation begins (Line 1) with a question about store rental videos, and moves on to Hitchcock films, along with references to a Vienna landmark.

Table 9. Data set excerpt: OT constraints and CG principles[10]

Line#	Sp.	Utterances	OT	CG
1.	M.	Do we need to return those store videos?	CpdStress	Normal
2.	F.	Oh yeah. they n– need to go back.	CpdStress (phrasal verb)	Normal
3.		Hey... you wanna watch one o' tho- pick up one of those uh Hitchcock movies {tonight}?	CpdStress	Normal
4.	M.	I don't know.	Contrast [FW]	Special
5.		Ya know I'm not a real Hitchcock fan.	CpdStress	Normal
6.	F.	I think Hitchcock movies are great.	Contrast	Special
7.		We should watch The Third Man	CpdStress	Normal
8.		and see if we recognize any uh- [incomplete utterance]	Ø	Ø
9.	M.	Viennese?	LCW	Normal
10.	F.	any of the Vienn- Vienna after the war.	LCW	Normal
11.		I'm sure we'd recognize St. Stephan's.	CpdStress	Normal
12.	A.	You'd like to work there once.	Contrast [FW]	Special
13.	F.	Since we saw it in its burned out stage,	CpdStress [FW]	Normal FW
14.	B.	and its cannonball.	CpdStress	Normal
15.	F.	Yeh uh: they could probably show a cannonball.	CpdStress	Normal
16.	B.	maybe they shot it a- [incomplete]	Ø	Ø
17.	A.	Out at Stephansdom?	CpdStress	Normal
18.	F.	Yeh.	Ø	Ø
19.	B.	It's just a weapon.	LCW	Normal
20.	A.	The Rise is a good Hitchcock movie	Contrast	Contrast-shift
21.		It's got Paul Newman in it.	CpdStress	Normal
22.		You'd love to watch it.	LCW	Normal NF
23.	F.	What is it?	LFW	Normal FW
24.	A.	It's The Rise.	Contrast [CW]	Special
25.	M.	One of those creepy scary... [incomplete]	Ø	Ø
26.	A.	It's... he's the won the Nobel Prize.	CpdStress	Normal
27.	F.	Yeh.	Ø	Ø

One complexity is apparent in the initial segment. In the first two lines, we see the verbs *return* and *go back*, each with new information stress (neither was produced with an extra contrastive prominence or amplitude that would indicate contrastive or emphatic stress). As a synonym of *return*, it would be considered coreferential and not informationally new, particularly in a functionalist-pragmatic

[10] This transcription indicates the line number, speaker (Sp), utterance, relevant OT constraints and CG designations. The speakers again are a father (M), a mother (G), a college-age daughter (K), a high-school-age daughter (L), and a male toddler (P). In line 3, the content word *tonight* serves as a minor, contextually backgrounded expression, and thus does not receive nuclear stress. In line 26, the speaker apparently meant an Oscar, not a Nobel Prize.

perspective (e.g., Bardovi-Harlig, 1986)[11]. In this case, a transitive verb (*return*) and an intransitive verb (*go back*) can be informationally different. A transitive verb involves an agent and an object (two semantic arguments), whereas an intransitive verb involves a thematic subject or item affected by an action (one semantic argument). These semantic argument structures themselves bear different meanings (Goldberg, 1995), and in this case can make *go back* informationally new, as it says something different about the subject (video tapes) than the transitive verb. This instance can be explained well by Goldberg's (1995) Construction Grammar (which is based on cognitive grammar), and this insight can easily be incorporated into the related cognitive grammar approach. The verb *return* denotes agent-directed motion of an object, while *go back* indicates motion without an agent or intentionality, thus providing a different meaning or nuance in the discourse. Thus, the general CG approach can draw from such insights to better explain such instances.

Another complexity arises with the compound stress on *Hitchcock* when this name is no longer new. When *fan* is the intended new information in line 5, the main stress still aligns with the prosodic head of the compound, and thus, *Hitchcock fan*; this follows the general compound stress pattern of English (see e.g. Giegerich, 2004), though emphasis may have been intended as well.[12] Other instances of sentence stress on the normal prosodic heads of compounds and phrasal verbs are seen elsewhere (e.g. *go back*, line 2; *cannonball,* line 15). This is accounted for by ranking CpdStress above LCW and LFW in the OT system, so that compounds are properly stressed. The linguistic rationale for this is one of economy; by promoting the prosodic head of the compound to a sentence stress, rather than another word (e.g. *fan*), speakers avoid creating extra stress levels and extra phonological structure (e.g. *Hitchcock fan*), which would be more difficult to manage articulatorily. OT economy (or faithfulness) constraints, and the specific constraints relevant to compound stress assignment (which are beyond the scope of this paper) might provide a more detailed theoretical explanation, especially of the prosodic, morphological and semantic factors involved. In CG, these can be treated as typical compounds, and as variants of the usual normal stress pattern.

Incidentally, in line 13, *stage* does not receive nuclear stress and is apparently treated as familiar semantic content (*We saw it in its burned out stage*). The most likely explanation here is that this stage was treated as presupposed knowledge, as this family had recently vacationed in Vienna and was familiar with the landmark (Stephansdom, or St. Stephen's Cathedral) and its post-war condition (after being severely damaged in World War II). For this, various pragmatic analyses that explain how some items like this can be implicit, pre-supposable, and assumedly familiar to speakers (e.g. Rooth, 2008); so even though the word *stage* is new to the discourse, it is familiar and relevant to them in the context, and can thus be de-stressed. This is otherwise difficult to predict, especially for theories outside of pragmatics, as one has to understand the speakers' perspective first-hand.

At first, OT and CG seem to account for special stresses equally well. A number of contrastive and emphatic forms can be seen, as in lines 4, 6 and 12, where speakers use special intentional emphasis, which is not necessarily predictable, and a double contrast in line 6. However, in OT, the special focus would simply be stipulated, and like other generative accounts, OT in its current form is less adept at including or considering speaker intention or similar pragmatic factors. The CG approach seems more adept at handling this, as the special stress is adapted in each utterance to a particular speaker-oriented function, such as emphasizing personal feelings, clarification, or initiating a topic shift.

Finally, the use of normal stresses facilitates a friendly flow of conversation, as most utterances follow a similar pattern of final or near-final nuclear stress, and build off one another. Most utterances with normal stress are additive, that is, adding on to what was previously said. This can be seen in the entire conversation in the Appendix, where the conversation is cooperative and consists of additive topic flow, and rhythmically similar sentences with normal nuclear stresses. This is consistent with the

[11] In some formal pragmatic and semantic formulations of focus and givenness, *go back* could be considered pre-supposable or coreferential with *return* (see, e.g. Rochemont, 2016). On the other hand, a lexically new expression like this could be considered new and focusable in a formal pragmatic/semantic framework like that of Riester and Baumann (2017).

[12] This accords with this author's intuition as a native English speaker as the most natural and most likely pronunciation in this context. Again, see also Lee (2007) and Hirschberg (1993) for counter-examples and some complicating factors. Alternatively, if the speaker wished to avoid linguistic conundrums, she could have said *I'm not really a fan of Hitchcock*, with a nuclear stress on *fan*.

CG view of normal stress (as discussed section 2.3 above), where normal stress can readily be used for such communicative functions.

4. Discussion

The results, as discussed below, indicate certain advantages for each approach, and the insights possible in the CG approach in particular point to the need for more research on the discourse functions of nuclear stress. For example, in response to the first research question, while OT presents a complex, fine-grained analysis of constraint interactions among different language modalities, the CG approach offers a more holistic explanation that allows for more explanation of sentence form, information structure, prosody, and sociopragmatics. In response to the second research question, basic stress patterns were found as expected, with the majority of stress tokens being normal stress patterns on final nouns. The data show regular use of normal stress for normal information flow and cooperative discourse, with some use of special stress for particular purposes. For these sociopragmatic functions, a CG account seems to have more to say than existing OT accounts.

4.1 Optimality Theory

The OT approach offers advantages for those doing linguistic analysis at the sentence level, namely, theoretical linguists (or those in natural language processing and computational linguistics), and especially those interested in the interface of different levels of linguistic modalities – syntax, prosodic phonology, compound morphology, and information structure within a sentence. It allows for a more detailed analysis of compound and phrasal patterns, when considering other constraints involved in compounding and phrasal syntax. An OT analysis offers an appealing account of the linguistic complexities involved in stress realization. It shows how focus and stress tend to align with the right or terminal edges of intonational phrases, syntactic clauses, and focus domains, and with new content words. Faithfulness constraints also explain how nuclear stress aligns with existing stress without creating new structure. In OT, the focus can be stipulated to include focal alignment with the sentence grammar and prosody, and to explain intonation at the sentence level. Another advantage of OT lies in its ability to provide a formal representation of the constraint interactions that lead to the surface form, via constraint hierarchies and evaluations. However, OT in its current form, or at least in the existing OT proposals for nuclear stress, has limitations. It does not go not beyond the sentence level to explain the discourse functions of prosody, discourse flow, or intonation at the discourse level. In and of itself (i.e. without turning to pragmatics for further insight), it does not offer an explanation for why speakers choose to place stress or focus on certain lexemes, especially for contrast, emphasis, or topic shifts, or how speakers might use stress and intonation for sociopragmatic purposes, such as agreeing, disagreeing, continuing with the same topic, or shifting topics.

The OT approach used here, and particularly with all the constraints and interactions in Lee (2013), offers the advantage of explaining the interaction of different levels of grammar – prosody, prosodic constituents (utterances or intonational phrases), stresses (lexical, compound and nuclear), focus, lexemes, and sentence-level syntax – via alignment constraints. This seems complex, but has the advantage of explaining the interaction of multiple linguistic features and structures. Also, the constraints are based on well-defined and established linguistic features and structures, and the rankings are designed to account for various data in the literature through their interactions. In this approach, information structure is treated as a multi-dimensional or hierarchical construct, consisting of primary focus (the most salient information, realized as nuclear stress), a secondary focus of sorts (i.e. other new information that is not stressed), backgrounded items (i.e. contextual or inferable material), and old information. This leads to a more complex and nuanced view of information structure, which deserves further exploration in future research.

This analysis also offers some advantages in predictability, as different constraint rankings can explain focus and stress effects in other languages. German,[13] for example, has very similar focus and nuclear stress patterns as English. However, subordinate and relative clauses have an SOV order, and dependent infinitives (like the *go* in *I must go*) are sentence-final. If the inflected verb does not receive

[13] This author speaks German as a second language, and below I refer to Korean and Mandarin, which I also speak fairly proficiently, so I am fairly confident here in my pronouncements about these languages.

focus, then the focused item (usually a final content word) would precede the verb. This is simply a matter of ranking a couple of syntactic constraints for such clauses above the alignment constraints discussed in Lee (2013). In Korean, all sentences are SOV, and Korean has no nuclear stress for normal focus. Focus is instead indicated by word order, with the primary focus placed before the main sentence-final verb (if the verb itself is not focused). In other languages with freer word order such as Greek, focus is realized primarily by word order (Keller and Alexopoulou, 2001), which would involve ranking stress alignment constraints so low that they have no effect in the grammar, and ranking focus-syntax alignment constraints above other syntactic constraints, e.g. the syntactic integrity constraint of Lee (2013) and other syntactic constraints.

However, certain universal tendencies also need to be explained in OT. There seems to exist a universal tendency whereby normal focus tends to be placed near the end of sentences and utterances, but no language known to this author does otherwise, e.g. constraints that end up placing the main focus (and/or nuclear stress) much earlier. Also, emphatic stress seems to be universal, even in languages like Korean and Mandarin with no nuclear stress; in Mandarin, for example, an emphatically stressed syllable has a greater intonational prominence mapped onto the contour of the lexical tone (Chen and Gussenhoven, 2008). No language exists (as far as this author knows) in which constraints on normal focus constraints outrank constraints on emphatic stress, such that emphatic stress is outweighed by normal stress or left unrealized. This seems to be a strong linguistic universal. For these tendencies and universalism, a more complete theory of constraint rankings and markedness would need to be developed within the OT framework. This is beyond the scope of this paper, but various explanations have been put forth (e.g. Desrochers, 1998; Flack, 2007; Xu and Aronoff, 2010).

4.2 Cognitive Grammar

The CG account sketched out in section 2.3 seems to account for the data just as well at the existing OT accounts of nuclear stress. Furthermore, it has more to say about why final or near-final nouns are most often stressed, due to their greater informational salience (Szwedek, 2011, 2017). It also has more to say about the sociopragmatic functions of stress in actual data like the data set in this paper. This data set contains mostly normal nuclear stresses that convey a normal, additive flow of information, whereby one utterance builds informationally on the previous one. As such, these rhythmic patterns also create a discourse that is cooperative and mutual. A simple final stress may indicate a simple informational contribution, while a non-final normal stress may signal a slightly more complex contribution (e.g. *Hey, you wanna watch … pick up one of those Hitchcock movies tonight*, line 3). At times, special stresses interrupt this flow for more speaker-oriented functions, such as emphasizing a speaker's own emotions (*I wanna see Darth Vader!* in line 135), contrast (*… who's a good guy, and Raymond Burr's a bad guy*, lines 60-61), topic shifts (*The other one that I haven't seen*, line 57), or utterances that seem to serve as contradictions or dispreferred responses (*Ya know, I'm not a real Hitchcock fan*, line 5; *I think Hitchcock movies are great*, line 6). Thus, normal stress seems more cooperative, while special stress seems to serve pragmatic functions that are more clarificational (e.g. contrasts), dispreferred, or speaker-oriented (e.g. affective emphasis). These inferences about sociopragmatic functions, especially of special stress, are somewhat tentative, and more empirical research is needed. Nonetheless, the CG approach can offer different insights, including hypotheses about sociopragmatic usage of prosody.

The CG approach can address some aspects of markedness and universal tendencies discussed above. The tendency of rightward placement of focus is explained by the novelty effect, a general psycholinguistic processing principle (Gernsbacher, 1990). Older information, by virtue of its previous mention, is held in the working memories of interlocutors. The information deemed most salient by a speaker is placed as much as possible near the end, so that listeners may attend to it more, that is, so they will devote more cognitive effort to interpreting the focused word or phrase and its relevance. Thus, the most recently heard item will tend to be remembered better, and will be more active in a listener's working memory. The effect can be enhanced in languages that use nuclear stress for normal focus. The use of prosodic marking for focus depends on the so-called effort code (Gussenhoven, 2016), that is, the amount of vocal effort used to produce greater duration, amplitude and pitch range serves as a cue to listeners of the greater significance of the piece of information. This particularly holds true for special emphasis, as this seems to be a linguistic universal, where special focused words generally have even greater intonational prominence (including, e.g., compared to normal focused words in languages with normal nuclear stress). The fact that nuclear stress for normal focus seems common in a number of

languages (at least among Western languages), and the likely near-universal use of special emphatic stress, are universals or tendencies that CG seems able to explain well, since these rely on general psychological processing effects and vocal cues that would be universally or widely interpretable.

4.3 Toward a cognitive grammar account of prosody

Though a complete account of prosody and stress in CG (that is, a proper cognitive phonology account) currently seems under-developed, it is possible to sketch out a more detailed explanation here, particularly for nuclear stress patterns such as those in the data. This is possible because CG models grammar based on a mapping of form, core meaning, and various related usages that are possible in context. It also allows for taking a default function or meaning and extending its usage via semantic extensions to new usages. As a result, the following can be hypothesized for nuclear stress in CG.

As a speaker nears the end of an utterance, air pressure in the lungs decreases; as a result, the air pressure below the glottis that sustains sentence intonation also decreases, and so the intonation and vocal amplitude naturally decreases at the end, especially after a prosodic peak (Ladefoged, 2015). In Western languages, this final declination is exploited sometimes by placing minor information there, such as anaphoric items and other minor information.[14] This final declination region (↘) can be immediate and sudden, occurring at the very end immediately after the most prominent predicate-final content word (*Let's go see a movie* ↘); or it can be extended and used for minor information, such as anaphoric pronouns (e.g. *Let's do* ↘ *it*), or the types of backgrounded information discussed above (e.g. *I'll go* ↘ *now*). A clause-final declination after a nuclear stress might enhance the perceptibility or prominence of the stressed item (Terken and Hermes, 2000), thereby highlighting the stressed lexeme as most relevant to the discourse. Final declination is a biological universal that can be exploited in languages to signal the end of an utterance (Hauser and Fowler, 1992), and this declination can thus signal turn completion or turn-holding in conversation (De Looze et al., 2014; Polyanskaya, Samuel and Ordin, 2019).

Nuclear stress tends to align with nouns or other content words due to their greater salience and concreteness (Szwedek, 2011), and by default it marks a lexeme as new to the discourse, that is, new in contrast to interpretation as an old or previously mentioned item (Szwedek, 2017). This new-old contrast is the default function or core meaning of nuclear stress, as reflected in its frequency in the data sets in this and previous studies. Normal stress allows for the normal, sequential progression of discourse. One sentence with a topic-focus structure can be followed by sentences with foci that either add further information about a topic over successive sentences; a stressed focus in a predicate can initiate a shift to a related topic or a subtopic; or a focal item in the predicate of one sentence can be taken up as the topic of the next sentence. These are topic-focus structures that are posited within discourse theories like Centering Theory (Walker et al., 1998). Normal stress allows for continuing and elaborating on a topic, as seen in the above data, where it allows for carrying forward the discourse about films, and introducing related sub-topics, such as particular films. In fact, this is seen in the entire six-minute data set, where several interlocutors use normal stressed foci to add more comments and details about a topical thread over several sentences or interchanges, and to make minor shifts to related topics, such as a specific film, and then converse about that.

The basic function of old-new contrast can be semantically extended to other contrasts, as semantic extensions are a key mechanism in CG for deriving new usages. Thus, nuclear stress can be extended from the normal stress pattern to other usages, such as more explicit semantic contrasts (e.g. *the red pill or the blue pill*), and non-explicit contrasts, i.e. pragmatic emphasis (for example, *Do it now* implies "not whenever you like").[15] Special stress can signal a disruption in logical flow, sentence topic, or speaker intention. Just as discourse connectives mark discontinuities in text (Zwaan and Radvansky, 1998), in an analogous manner, emphatic stress marks a discontinuity in spoken discourse. The intonation and placement of special stress mark a break in standard normal information flow and capture the listener's attention for specialized discourse functions. Gaining attention can be used for

[14] Languages like Korean and Japanese exploit this final declination by aligning it with sentence-final particles and verb endings.

[15] The nature of explicit and implicit contrasts and special emphasis is beyond the scope of this paper, and will need be addressed in a future study.

simple emphasis, and other functions can be derived from this, such as contrasts, emotive emphasis, clarification, repair, or even topic shifts, by drawing attention to a topic that differs from that of the previous utterance or from what is expected. All these functions are related to and derived from an attention capture function of special stress.

Since nuclear stress marks the focus, and thus the speaker's intention, in a CG, functionalist or pragmatics framework, it is possible to hypothesize on the discourse functions of nuclear stress. The family conversation in this study was a positive and even convivial conversation, with interlocutors taking up and elaborating on one another's topic with normal stress patterns. This pattern of uptake and topic continuity seems to convey positive politeness, being attuned to others' interests, and thus, intersubjectivity, or showing rapport by shaping one's communication toward the interests and expectations of others. These patterns might even be described as psychological mirroring, that is, expressing solidarity and rapport with another by imitating each other's behavioural patterns (e.g. body language and paralinguistic cues). Further research is needed on this, as well as the possibility that special stress may play a role in marking dispreferred responses or mitigating negative politeness, or its role in positive politeness (cf. Hirschberg, 2004, Estebas-Vilaplana, 2014). These hypotheses about sociopragmatic functions of nuclear stress require empirical testing to determine their validity, e.g. within a CG framework.

A CG approach can draw from psycholinguistics and cognitive research, and a relevant line of research here is work on sentence processing. In reading texts, readers rely on clause boundaries and final punctuation as cues for the end of meaning units, at which points readers then interpret and integrate the meaning of the entire sentence into their online comprehension of the preceding contents (e.g. Duffy, 1986; Kintsch, 1998). This so-called integration or final wrap-up underlies the process of comprehending sentences and one's understanding of the entire text, via updating one's discourse schema or mental representation and understanding of the text meaning as one reads each sentence. Written text establishes textual cohesion and coherence via connectors, similar verb types, anaphoric references, multi-sentence paragraphs, complex sentences, and other linguistic devices (McNamara et al., 2014), while conversational discourse would rely less on such devices. For auditory comprehension, psycholinguistic evidence indicates that sentence-final boundaries and final keywords are indeed relevant for processing and interpreting spoken sentence contents, and that listeners expect these as cues for sentence comprehension (e.g. van den Brink, Brown and Hagoort, 2006; Diaz and Swaab, 2007). A CG account would lead to the hypothesis that nuclear stress juxtaposed with final declination in languages like English can signal the end of a meaning unit for processing, and indicates the most salient cue for interpretation of the sentence. The default would be normal stress for topic continuity, where nuclear stress and final declination would serve as cues for wrap-up, taking the stressed item as a focus for integration onto one's online discourse schema for the conversation. Special stress would signal other interpretations such as topic shifts, contrasts, or emphasis. These are also hypotheses that require further research and empirical testing, but again, the CG approach allows for such interesting questions and hypotheses.

5. Conclusion

Both the OT and CG frameworks offer worthwhile and valuable insights, and both have their advantages. The OT approach offers interesting insights into the abstract linguistic structures and the complexities involved in the interactions of various linguistic domains and constituents. It captures the detailed interactions among different structures and language modalities, and it is detailed and flexible enough that it seems capable of accounting for focus and stress patterns in other languages. It may seem complex, but this complexity may be warranted by its explanatory ability, potentially for various other languages, as well as for the complexities of stress patterns in English. However, as a generative paradigm, it is not designed to address sociopragmatic questions or questions of speaker intentions, and so it is much less agile in entertaining pragmatic, interactional or psycholinguistic questions like those discussed above. It is also difficult to see how the OT approach could lead to pedagogical applications, such as a straightforward means of teaching stress patterns to learners.

The CG approach cannot capture the abstract structures and complexities that an OT analysis can show. However, it has other advantages, as it can allow us to entertain questions about discourse and sociopragmatic uses of normal and special stress in natural conversations. Normal stress seems to play a role in topic continuity and development, and special stress can be used for clarification, corrections,

explanatory contrasts, and topic shifts. Such data raise questions about the role of stress in politeness, cooperation, and topic management. Here, CG seems to offer more explanation of the discourse functions of stress, and it also allows for hypotheses about the role of stress in sociopragmatics, discourse flow, and even in sentence processing. These are all interesting research questions that require further investigation. The CG approach seemingly offers more in applicability and testable hypotheses about contextual uses of stress. It specifically seems more applicable for discourse analysis, pedagogy, and psycholinguistic research. Thus, the findings here indicate a need for much more discourse level research on nuclear stress.

The CG approach also seems more amenable for L2 pedagogy, as improper rendering of nuclear stresses can impede communication and listener understanding of a speaker's intended meaning (Derwin and Munro, 1997; Field, 2005). Such difficulties are notable for those whose L1 lacks normal nuclear stress, such as Korean learners of English (Um, 2004; Kim, 2007). The basic final normal stress pattern can be taught as a default pattern, followed by sub-patterns with non-final normal stress. Contrastive and emphatic stress can be taught (and these would not be unfamiliar, as most known languages probably have such patterns), followed by specialized uses, such as clarification, contradiction, correction, and topic shifts. These ideas for pedagogy will be addressed in future research.

This study indicates the need for more work on the discourse functions of nuclear stress and on formulating a cognitive grammar approach to phonology. This study is based on data from a single friendly family conversation of 5.5 minutes, which was sufficient to illustrate some typical patterns and how a CG framework could account for them. However, the data set is somewhat brief and limited to a single amicable family conversation, so the generalizability of this one study may be limited. More data analysis with various conversational types are needed to confirm the results of this study, to further explore account of nuclear stress, and to further develop a cognitive phonology paradigm based on CG. In addition to stress placement in utterances, the intonation and phrasal patterns need to be included in future research, including pitch and boundary notations using a transcription system like ToBI (Beckman and Ayers, 1997) to investigate intonational patterns more in-depth. Much further research remains, for example, in studying longer conversational data sets and in different discourse genres, e.g. lectures, debates, monologues, and different conversational topics and styles. Study of different conversational contexts is needed, including more formal and more adversative conversations, where one might find more frequent use of special stress. Insufficient work has been done on the role of nuclear stress in topic management or its sociopragmatic functions. Various hypotheses have been sketched out about the informational, sociopragmatic and psycholinguistic functions of stress, and these require empirical study and validation with different discourse forms. Such work can hopefully be reported later, which can provide more insights on discourse structure, and can help further develop cognitively and socially oriented theories of communication.

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Appendix

The following abbreviations and symbols are used: (1) sentence stresses are underlined; (2) utterances with no stresses are marked with the null (Ø) sign; (3) final backgrounded items appear in curly braces {}; (4) lengthened vowels are indicated with colons (:); and (4) the beginnings of two overlapping utterances are marked with square brackets ([ ). The speakers are the mother (M), the father (F), an adult daughter (A), a teenage daughter (B) and a male child (T). Personal names have been altered for privacy reasons.

Table 10: Pedagogical system applied to a corpus

Line#	Speaker	Utterance	OT Constraints	CG patterns
1.	M.	Do we we need to return those store videos?	LCW	Normal
2.	F.	Oh yeah. they n– need to go back.	CpdStress [FW] (phrasal verb)	Normal
3.		Hey... you wanna watch one o' tho- pick up one of those uh Hitchcock movies {tonight}?	CpdStress (compound noun)	Normal
4.	M.	I don't know.	Contrast [FW]	Special
5.		Ya know I'm not a real Hitchcock fan	CpdStress (cpd. Noun)	Normal
6.	F.	I think Hitchcock movies are great	Contrast [FW, CW] (double contrast: *great*, *I*)	Special
7.		We should watch The Third Man	CpdStress	Normal
8.		and see if we recognize any uh-	Ø	Ø
9.	M.	Viennese?	LCW	Normal
10.	F.	any of the Vienn- Vienna after the war.	LCW	Normal
11.		I'm sure we'd recognize St. Stephan's.	CpdStress	Normal
12.	A.	You'd like to work there {once}.	Contrast [FW]	Special
13.	F.	Since we saw it in its burned out stage,	CpdStress [FW]	Normal FW
14.	B.	[and its cannonball	CpdStress	Normal
15.	F.	[Yeh uh: they could probably show a cannonball.	CpdStress	Normal
16.	B.	maybe they shot it a-	Ø	Ø
17.	A.	Out at Stephansdom?	CpdStress	Normal
18.	F.	Yeah.	Ø	Ø
19.	B.	It's just a weapon.	LCW	Normal
20.	A.	The Rise is a good Hitchcock movie	Contrast [CW] (topic shift)	Contrast-shift
21.		It's got Paul Newman in it.	CpdStress	Normal
22.		You'd love to watch it	LCW	Normal NF
23.	F.	What is it?	LFW	Normal FW
24.	A.	It's The Rise,	Contrast [CW]	Special
25.	M.	One of those creepy scary...	Ø	Ø
26.	A.	It's... he's the won the Nobel Prize	CpdStress	Normal
27.	F.	yeh	Ø	Ø
28.	T.	(*child screaming*)	Ø	Ø
29.	F.	ah I see (*unclear*)	Ø	Ø
30.	A.	Don't scream in my ear.	LCW	Normal
31.	M.	What's he want?	LCW	Normal
32.	T.	(*child moaning*)	Ø	Ø
33.	M.	Does he need a napkin?	LCW	Normal
34.	B.	All ya gotta do is-	Ø	Ø
35.	A.	You have a napkin right here.	Contrast [FW]	Special
36.		In front of your face, {remember}?	LCW	Normal NF
37.		you folded it out.	CpdStress [FW]	Normal cpd
38.	A.	I've thought about maybe getting Notorious	LCW	Normal

Line#	Speaker	Utterance	OT Constraints	CG patterns
39.	F.	I've never seen that.	Contrast [FW]	Special
40.	A.	Oh that's a good movie	Contrast [FW]	Special
41.		Oh Mom	LCW	Normal NF
42.		You'd really like that one	Contrast [FW]	Special
43.		It's got uh-	Ø	Ø
44.		What's his name	Contrast [FW]	Special
45.	F.	uh...	Ø	Ø
46.	T.	*(babbling)*	Ø	Ø
47.	A.	Ingrid Berg- Bergman and,	Ø	Ø
48.	F.	Dunno.	CpdStress [CW] (verb in contraction)	Normal cpd
49.	B.	(*unclear*)	Ø	Ø
50.	A.	No, um actor...	LCW	Normal
51.		famous actor	LCW	Normal NF
52.		Arsenic and Old Lace.	CpdStress	Normal cpd
53.		Rough Day on the Bus.	CpdStress	Normal cpd
54.	F.	Jimmy Stewart?	CpdStress	Normal cpd
55.		nah, Cary Grant.	CpdStress	Normal cpd
56.	A.	Cary Grant.	Contrast [CW]	Special - shift
57.	F.	The other one that I haven't seen	Contrast [FW]	Special – contrast
58.		is Rear Window,	CpdStress	Normal
59.		It's got Jimmy Stewart	CpdStress	Normal cpd
60.		who's a good guy	Contrast [CW]	Special – contrast
61.		and Raymond Burr's a bad guy,	Contrast [CW]	Special – contrast
62.	A.	That one I've heard is a little strange	LCW	Normal
63.		but I haven't seen it.	LCW	Normal NF
64.		Notorious though	Contrast [CW]	Special – contrast
65.		It's the one where he's uh Cary Grant's a spy,	LCW	Normal
66.		and, Ingrid Bergman is the daughter of a Nazi German	LCW	Normal
67.		who- who just committed suicide after a trial	LCW	Normal
68.		an' they want her to- to infiltrate his …	Ø	Ø
69.	F.	...contacts.	LCW	Normal
70.	A.	yeah his colleagues -	LCW	Normal
71.		they fall in love.	LCW	Normal
72.	M.	Oh, that might not be bad.	LCW	Normal
73.	A.	Figures	LCW	Normal
74.	M.	I think I'd like that.	LCW	Normal
75.	A.	mm hm.	Ø	Ø
76.	A.	You might have actually seen it	LCW	Normal
77.		because when I was taking that film class.	CpdStress	Normal cpd
78.		I checked it out.	CpdStress [FW]	Normal cpd
79.		and watched it.	LCW	Normal
80.	F.	I didn't realize that-	LCW	Normal
81.		that film Rebecca was just talking about.	CpdStress (phrasal verb)	Normal cpd
82.	F.	oh yeah.	Ø	Ø
83.	A.	Have you seen it?	LCW	Normal NF
84.		or just while I was watching it a billion times.	Contrast [CW]	Special
85.	F.	ahaha I've heard it from a distance about a billion times.	Contrast [CW]	Special

Line#	Speaker	Utterance	OT Constraints	CG patterns
86.	A.	while I was writing my - my papers.	LCW	Normal
87.		Yeah, she she said being there in the class	LCW	Normal
88.		that we're, gonna pick one Hitchcock film	CpdStress	Normal cpd
89.		an' be sick of it by the time the semester is over.	Contrast [CW]	Special
90.	F.	Why does she say Hitchcock?	Contrast [CW]	Special
91.	A.	It's because, Hitchcock is...	Ø	Ø
92.	T.	(*mimetic babbling*)	Ø	Ø
93.	F.	the master.	LCW	Normal
94.	A.	yeah	Ø	Ø
95.	B.	Hitchcock. (*emphatically clarifying*)	Contrast [CW]	Special
96.	A.	His uhm films are are incredibly well organized and thought out.	CpdStress	Normal cpd
97.	A.	He has he wou- would make diagrams of almost all the shots and...	LCW	Normal
98.	F.	Really	LCW	Normal
99.	A.	fer, yeah fer-... that's how they we're able to make that new Psycho uhm...	LCW	Normal
100.	A.	They used all of his his notes, {yes}.	LCW	Normal NF
101.	A.	So it was actually... it was exactly the same as the original...	Contrast [CW]	Special
102.		except for the actors.	LCW	Normal
103.	F.	Including the dialogue?	LCW	Normal
104.	A.	I think so.	LCW	Normal NF
105.	B.	Oh please pass the salad.	LCW	Normal
106.		A:nd, both dressings.	Contrast [FW]	Special
107.	F.	uh uh.	Ø	Ø
108.	A.	So it's a very very interesting idea.	LCW	Normal NF
109.	F.	yeah. uhm...	Ø	Ø
110.	A.	even though it kinda flunked.	LCW	Normal
111.	B.	What idea?	Contrast [FW]	Special
112.	A.	But, anyway so if we make a Hitchcock movie from his, old notes.	LCW	Normal
113.	B.	It wasn't a good movie?	Contrast [CW]	Special
114.	A.	What?	LFW	Normal FW
115.	B.	It wasn't a good movie?	Contrast [CW]	Special
116.	A.	I: heard it wasn't that good.	Contrast [CW]	Special
117.		because it wasn't in color.	LCW	Normal
118.	F.	Modern movie goers are are not into …	Contrast [FW]	Special
119.	A.	æh I don't think that's the reason.	Contrast [FW]	Special
120.		I think that most modern movie goers aren't sophisticated {enough}	LCW	Normal NF
121.	B.	It wasn't in color?	LCW	Normal
122.	A.	...[to] appreciate	LCW	Normal
123.	A.	No, it wa:s in color.	Contrast [FW]	Special
124.	F.	They think ya throw in a ton of special effects	CpdStress	Normal cpd
125.		that's all ya need	LCW	Normal
126.	A.	To thrill?	LCW	Normal
127.	B.	Yes.	Ø	Ø
128.	F.	Speaking of special effects	Contrast [FW]	Special – shift
129.		I saw in the paper {last night}	LCW	Normal NF
130.		that they're filming Star Wars episode two {now}.	CpdStress	Normal NF

Line#	Speaker	Utterance	OT Constraints	CG patterns
131.	A.	Yeah	Ø	Ø
132.	B.	No, they've been filming that one for a while.	Contrast [CW]	Special
133.		and it'll be out in about two months.	Contrast [FW]	Special
134.	T.	I wanna see- I wanna see Darth Va:der.	CpdStress	Normal cpd
135.		I wanna see Da:rth Va:der.	Contrast / CpdStress	Special
136.	A.	Ya wanna see Darth Vader?	Contrast [CW]	Special
137.		You've seen Darth Vader {before}.	Contrast [CW]	Special
138.	M.	Uhm, Kay could ya sorta pass that salad {please}.	LCW	Normal NF
139.	F.	You oughta watch episode six {sometime}, {T}	CpdStress	Normal NF
140.		I don't think you've ever seen that	Contrast [FW]	Special
141.	T.	What is it?	LFW	Normal FW
142.	B.	uh	Ø	Ø
143.	A.	The original Star Wars?	LCW	Normal
144.	T.	Yeah.	Ø	Ø
145.	A.	Yeah he has	Contrast [FW]	Special
146.		You've seen it {before}.	Contrast [CW]	Special
147.	M.	I don't he'd ever seen it.	Contrast [CW]	Special
148.	B.	Remember with Luke in it, an...	LCW	Normal NF
149.	A.	Luke Skywalker?	CpdStress	Normal cpd
150.		No?	Ø	Ø
151.	T.	I didn't see that one.	LCW	Normal NF
152.	F.	How is Miss (B, *unclear*) {today}.	CpdStress	Normal cpd
153.	B.	(*unclear mumbling*)	Ø	Ø
154.	F.	She give the ticket to (*unclear*)?	LCW	Normal NF
155.	B.	Don't know,	LCW	Normal
156.	T.	Say I wanna go watch the Darth Vader movie.	CpdStress	Normal cpd
157.	F.	Where ya goin B?	LCW	Normal NF
158.	B.	To change	LCW	Normal
159.	M.	She's gotta go to work.	LCW	Normal
160.	F.	oh.	Ø	Ø
161.	T.	She gonna do libwæwy work?	CpdStress	Normal cpd