INFORMATION, TRUTH, STRUCTURE, AND SOUND

by

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The irony of completing this dissertation is that even though it ends up with only my name on it, there is no way I could have ever finished this by myself. The list of people that have made this possible is a very long one, and I am certain I will leave someone out, but I want to try to mention some of the bigger players in finally bringing this to some kind of conclusion. Of course, none of these people should be blamed for the abundance of problems, shortcomings, and errors that doubtlessly remain

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ABSTRACT

A persistent element of the Principles & Parameters framework is the T-model of grammar. The strong claim of this model is that phonological rules cannot refer to semantic entities, and *vice versa*. However, apparent interactions between prosody and semantic interpretation provide a *prima facie* challenge to this model. I propose a theory of Information Structure (IS) and its related interfaces that is sufficient to account for apparent semantic-prosodic interactions while still satisfying the strong requirements of the T-model. This proposal hinges on three inter-connected sub-proposals.

First, I defend a representation of IS based on two kinds of primitives, *partitions* and *instructions*. The partitions are nested structures derived from sub-trees of LF. The instructions are functions that operate on the partitions to specify their connection with the discourse. Interactions between these primitives account for apparent truth-conditional effects of IS.

Second, I propose that IS partitions are generated in the syntax *via* the mechanism of derivational phase, or cyclic Spell-Out. I claim that phases are determined by interface conditions, and that IS provides some of those interface conditions, such that some phases will be isomorphic with IS partitions. Not only does this theory provide appropriate structures for IS, but it does so without violating the T-model, and it manages to leave previous work on phases intact.

Third, my phase-based proposal provides an indirect correlation between phonological stress and IS. Because stress rules apply cyclically at each phase, and because IS dictates some phases, stress and IS will naturally synchronize, without

needing to stipulate a connection between emphasis and information. This has the added

benefit of deriving so-called "narrow" or "contrastive" focus by the same set of principles

as "default" or "informational" focus.

Finally, my combined theory accounts for recalcitrant data involving the

connection between prosody, information, and Diesing's (1992) Mapping Hypothesis in

the interpretation of indefinites, and involving the link between prosody and underlying

position in data from Bresnan (1971). The end result is a unified theory of IS and its

interfaces, which maintains the T-model architecture and represents a streamlined

theoretical and empirical improvement across several domains.

CHAPTER 1

INTRODUCTION

1.1   The architecture of grammar

A fundamental aspect of any theory of grammar is the architecture of how different

dimensions of language (and the rules that govern them) relate to each other. It is

assumed by most theories that language involves the coordination of several different

kinds of linguistic structures (e.g., phonological, syntactic, semantic), and a basic issue

for any theory of grammar is formulating the relationship between these different kinds

of structure. How are the structures different or similar, and how do they interact?

One of the defining aspects of the architecture of grammar in the Government &

Binding (GB) and Minimalist traditions (cf. Chomsky & Lasnik 1977; Chomsky 1981,

1995) is the strict separation between semantic structure and phonological structure. This

so-called "T-model" or "Y-model" hypothesizes that syntax is the sole intermediary

between sound and meaning in the grammar.[1] Chomsky (1995) claims that the linguistic

system interfaces with (at least) two distinct mental systems, the articulatory-perceptual

system and the conceptual-intentional system. The linguistic representation of phonology

(PF, mnemonic of "Phonological Form" or "Phonetic Form") interfaces with the

articulatory-perceptual system, in order to coordinate the perception of language as well

as the physiological motor control needed to produce language. The representation of

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[1] Clearly, the lexicon must instantiate sound-meaning pairs in lexical entries. However, this pairing of denotative meaning and phonological content is (largely) arbitrary and unrelated to the grammar. That is, the relation between the meaning of a word and the sound of the word (e.g., why the sound string /dag/ has the meaning of *dog*) is unrelated to the computational system of the grammar, which is the issue at hand.

semantic structure (LF, mnemonic of "Logical Form") interfaces with the conceptual-

intentional system, in order to give cognitive processes such as memory and reasoning

access to the meaning carried by the linguistic signal. Mediating between PF and LF is

the core syntactic system, which is responsible for creating a structure that provides the

basis of linear ordering (for PF) as well as hierarchical structure amenable to a

compositional semantic system of interpretation (at LF). The strong claim of this model

is that direct connections between PF and LF are strictly disallowed. Figure 1-1 provides

a schematic view of this model.

Figure 1-1: Schematic model of GB/Minimalist grammar

```
                        ┌──────────┐
                        │  Syntax  │
                        └──────────┘
                        ╱          ╲
                       ╱            ╲
              ┌──────┐                ┌──────┐
              │  PF  │                │  LF  │
              └──────┘                └──────┘
                 │                       │
                 ▼                       ▼
articulatory-perceptual system     conceptual-intentional system
```
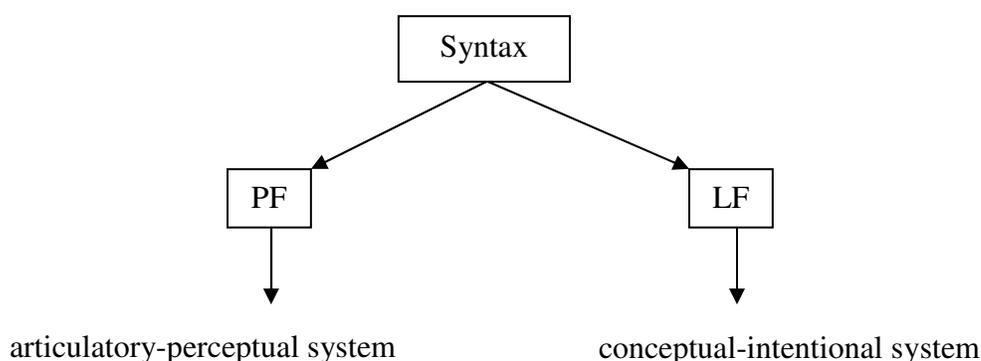
Examples of direct connections include rules of semantic interpretation (at LF) that

needed to refer to a phonological (PF) structure, and *vice versa*. The Minimalist

reasoning against such cross-talk between PF and LF is for reasons of interface legibility.

By definition in this system, LF is all and only the linguistic features needed for interface

with the conceptual-intentional system, and PF is all and only the features needed for the

interface with the articulatory-perceptual system. Allowing operations and PF or LF to

access the other's representation directly contradicts this basic claim about the function of these levels of representation.

1.2   A *prima facie* challenge to the model

Despite the appeal of this kind of model, there are many cases in which prosodic and intonational structure interact with the logical semantic properties of a sentence, in apparent counterexample to this claim. In this thesis, I aim to look closely at one such apparent counterexample, and I ultimately argue that a subtle modification to the current Phase Theory of Chomsky (2000, 2001) will capture this phenomenon without discarding the fundamental T-model.

Consider the following. The director of an agency responsible for government intelligence is under investigation for illegal wiretapping practices. He is asked whether a certain list of homes were included in the wiretapping, and he responds under oath as in (1).

(1)   All of the homes weren't wiretapped.

In the facts of this scenario, a few of the homes at issue were wiretapped (though not all of them), and the director knows this. The question is, did the director answer the question truthfully? The answer probably depends a fair amount on how he actually

uttered the sentence. Consider two possible intonation patterns, given in (2) and (3) below.[2]

(2)   ALL of the homes weren't wiretapped.

       H*   L-L%

(3)   ALL of the homes weren't wiretapped.

       H*   L-H%

In (2), the sentence ends with a falling pitch contour and strongly implies that none of the homes were wiretapped. This is the "perjury" reading, in which the director is categorically denying the wiretapping of any of the homes at issue, even though he knows this is false. If uttered with the rising contour in (3), however, it is a much more evasive answer, and less likely to be perjury. With this utterance, the director is strongly implying that while it is not the case that every house was wiretapped (which is true, in this situation), it is possible, and even likely, that some of the houses were indeed wiretapped (also true in this situation). In other words, depending on the prosodic contour the director used to pronounce the sentence in (1), his statement could be construed as true or false in the same set of circumstances.

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[2] Here and throughout, I will use SMALL CAPS to designate heavy stress (i.e., pitch accent, see sections 2.4 and 4.2). Here I also use a superimposed line to represent a pretheoretical, impressionistic pitch curve (F_0). A ToBI-style transcription (Hirschberg & Beckman 1994) is given as well for reference, though this transcription style is not discussed until sections 2.4 and 4.2.

This appears to be a case in which PF and LF are directly interacting. The difference in meaning between the two readings can be cast as one of logical scope, namely the relative scope of the sentential negation and the quantifier *all*. The dominant readings for (2) and (3) are given in logical notation in (4) and (5), respectively.

(4) $\forall x$ (x is a home)(¬ wiretapped (x))

(5) $\neg \forall x$ (x is a home)(wiretapped (x))

The meaning in (4) can be paraphrased, "for every x, where x is a home, x was not wiretapped," and (5) can be paraphrased, "it's not the case that for every x, where x is a home, x was wiretapped." The critical difference is where the negation applies in the formula, specifically whether it is inside the scope of the universal quantifier, as in (4), or outside of it, as in (5). Intonation and prosody are clearly part of the PF representation, and logical scope is a quintessential property of LF (cf. May 1977, 1985). Does this example therefore provide strong evidence against the model of grammar shown in Figure 1, by revealing a direct PF-LF connection?

1.3   The role of Information Structure

The answer I defend in this dissertation is "no." This claim itself is not novel, but the manner in which it is defended is. Since examples such as (2) and (3) were introduced seriously into the literature by Jackendoff (1972), they (and their analogues in languages such as German and Greek) have been analyzed as being mediated by Information

Structure (Jackendoff 1972; Kadmon & Roberts 1986; Büring 1995, 1997; Krifka 1998; Martí 2001; Baltazani 2002). That is, the T-model is defended by the claim that intonation is a reflection of Information Structure[3] (henceforth IS), and that IS somehow restricts the interpretations generated at LF. This line of defense suggests the following addition to the T-model.

Figure 1-2: Modified T-model
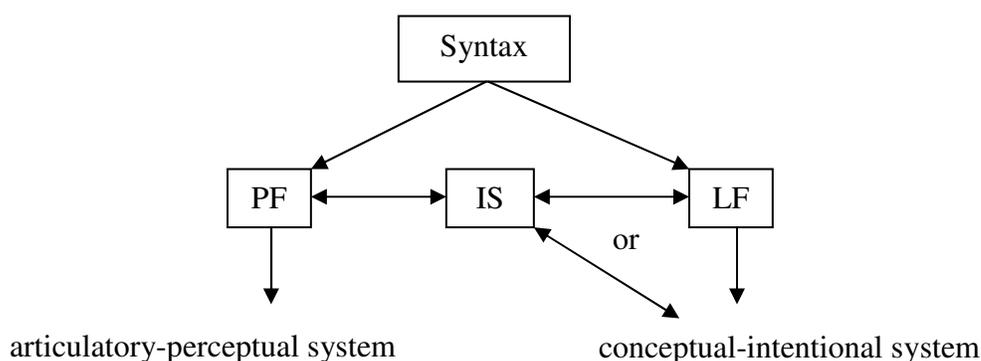
In this revised model, PF and LF are still not allowed to interact directly, but IS is permitted to mediate between them, in addition to syntax.

However, this defense of the T-model raises several critical questions, which this dissertations aims to illuminate, and ultimately I will propose an alternative. First, the meaningfulness of the model in Figure 1-2 depends on IS and LF being distinct representations. If in fact IS is a part of LF, then the revised model is much less clearly a defense of the PF-LF divide in the T-model, because admitting a PF-IS connection would

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[3] Under various other names such as Topic-Focus structure, theme-rheme, topic-comment, etc. See Chapter 2 for a thorough discussion of IS.

be tantamount to admitting a PF-LF connection. In several of the analyses mentioned above, the role of IS is seen as a kind of post-LF "filter" on possible meanings. That is, LF generates meanings, and IS helps select which meaning is used by the conceptual-intentional system. This kind of analysis raises the distinct possibility that LF and IS are in fact identical, if we assume (following Chomsky, 1995) that LF represents the only interface to the conceptual-intentional system. In short, there are reasons to be suspicious about whether LF and IS are as distinct as the model in Figure 1-2 implies.

The second question that arises is the question of whether IS is distinct from syntax. The model in Figure 2 suggests that IS is a mediating structure between PF and LF, but so is syntax. How is the IS mediation different from the syntactic mediation? Can IS be represented more parsimoniously as part of the syntax itself, or must it be an independent level of representation? Can IS be incorporated into the syntax without otherwise violating the architecture of the model? Answering such questions is crucial to understanding whether data such as (2) and (3) constitute evidence against the T-model of grammar.

Completing the triangle, the final question has to do with how IS interacts with PF. The claim of the model in Figure 1-2 is that it is not intonational structure *per se* that influences scope readings, but rather IS, which is in turn instantiated by PF. However, this argument may turn out to be simply a dodgy shell game, unless it can be demonstrated that IS has some independent existence apart from PF. That is, simply converting the name of the intonational PF term "pitch accent" to the IS term "Focus" before accounting for its effects on scope readings does not constitute a true mediation in

the sense that would preserve the T-model in a meaningful way. Addressing this issue

relies in part on the answer to the question of the IS-syntax relation, because if IS were

represented inside the syntactic system, it could have PF effects in a natural, constrained

way that is consistent with the T-model. Once the syntactic issue is resolved, it becomes

a question of whether the IS representation in the syntax is sufficient to give rise to the

observed phonological patterns in the data.

1.4   Seeking answers

The rest of this dissertation is concerned with illuminating these questions raised by the

inclusion of IS in the grammatical model, and with providing a unified set of answers. In

particular, I will develop a theory that 1) accounts for a variety of data in which IS

apparently affects truth conditions, 2) provides a unified explanation for the semantics,

syntax, and phonology of such data, and 3) is able to maintain the T-model's split

between LF and PF in a meaningful way. Along the way, it will present arguments that

previous theories are not capable of all three achievements.

        The rest of this introductory chapter has two goals. First, it gives a brief sketch of

the following chapters, and second, it provides a preview of the complete analysis. The

preliminary analysis works through a very simple example, in order to illustrate how the

overall theory proposed here integrates the various aspects of a single derivation. It is not

intended to provide any real evidence or argument for this theory, but merely serve as

foreshadowing, to help orient the reader for the exposition to come.

1.5   Outline of chapters

Chapter 2 develops a theory for how LF and IS are related. It focuses on explaining data

such as (2) and (3) above, where IS apparently affects the truth-conditional semantics of

the sentence, which is presumably the domain of LF. In addition to the particular

phenomenon in (2) and (3) (so-called "scope inversion"), this chapter deals with a wide

range of phenomena, primarily those sketched in Partee (1991) and Partee, Hajičova, &

Sgall (1998), including focus particles (e.g., *only*, *even*, *also*), counterfactuals, modals,

stage-level vs. individual-level predicates, generics, and *because*-clauses.

        The theory developed in Chapter 2 follows an essential idea from Chafe (1974)

and Vallduví (1992), among others, that IS represents a partitioning or "packaging" of the

denotations of a sentence for use in relating to the discourse. I discuss previous

treatments of what exactly the partitions are, primarily from three prominent theories: 1)

the more or less mainstream group of theories I term "Topic-Focus" theories, for lack of a

better common term;[4] 2) Steedman's (2000a, 2000b) two-dimensional system of theme-

rheme and background-focus; and 3) Vallduví's (1992) tripartite theory of link-focus-tail.

The review of these theories will serve to orient the reader to the issues at hand, and the

continuing exposition will continually refer back to these theories, in order to draw

comparisons and highlight how the present theory is distinct from them.

        The theory I develop in Chapter 2 owes most in spirit to Vallduví (1992), though

it differs in many critical details. In short, the chapter develops and defends a theory in

which IS has two interacting components: a set of *partitions* that act as informational

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[4] Represented by authors as diverse as (but not limited to) Chomsky (1965, 1971), Jackendoff (1972), Reinhart (1982, 1995), Rooth (1985, 1992), Büring (1995, 2005), and Erteschik-Shir (1997, 2006)

units, and a set of operations that act on those units. I hypothesize that these operations

should be formulated solely in terms of instructions from the speaker as to how the hearer

should update their knowledge or discourse model. I then illustrate how a system

composed of these simple primitives – partitions and instructions – is sufficient to give

rise to the various truth-conditional effects mentioned above.

One difference between the theory developed here and that of Vallduví (1992)

that bears on the architectural issues at hand is that while Vallduví (1992) argues that IS

is an independent level of structure, I argue that IS is a set of sub-units of LF itself.

Chapter 2 motivates this distinction, and discusses how it relates to the larger

architectural questions raised so far.

Chapter 3 tackles the issue of how IS relates to the syntax, and more generally

how the partitions and instructions themselves make it to LF for interpretation. In

particular, following the great majority of researchers in this area, I hypothesize that IS is

in fact represented in the syntax itself, and is not an entirely distinct structure. However,

I argue that the traditional (i.e., since Jackendoff 1972) ways of representing IS in the

syntax undermine the entire PF-LF distinction. The argument is presented in more detail

in Chapter 3, but in short, the standard use of diacritic features such as [F] (for "Focus")

in the syntax is a clear violation of Chomsky's (1995) Inclusiveness principle (i.e., do not

introduce non-lexical features into the syntax), which is tantamount to dissolving the PF-

LF divide. This criticism is readily admitted by several researchers (e.g., Zubizarreta

1998; Szendrői 2004; Erteschik-Shir & Strahov 2004; Erteschik-Shir 2006), but is

typically dismissed as an exceptional case. I argue that the "exceptional" nature of IS

does not make it exempt from the architecture of grammar, nor does it save the T-model from the problems of F-marking theories of IS.

As an alternative, I propose a re-working of the recent notion of syntactic "phase" (Chomsky 2000, 2001). In short, I claim that the "size" of phases is determined by interface conditions, not at predetermined functional heads such as C and *v*. I then argue that IS provides interface conditions to partially determine phases. In turn, phases serve as the mechanism for creating the IS partitions argued for in Chapter 2, not via an application of diacritic features to nodes (i.e., F-marking) as is standard, but rather as a by-product of the phase mechanism itself.

In intuitive terms, a phase is a sub-constituent of a sentence, which is "shipped off" to PF and LF prior to the completion of the entire sentence's derivation. Such a completed phase is available, though impenetrable, to later syntactic processes in the derivation. This process of building sub-units and "packaging" them separately is precisely the kind of mechanism needed to create the partitions needed for IS. In addition, because a phase is shipped simultaneously to LF and PF, it allows for the phase packaging to have parallel but independent effects at both interfaces.

This notion of phase is closely related to Bresnan's (1971, 1972) suggestion that the syntactic and phonological cycles are synchronized. She uses data from stress patterns to argue for this idea. Similarly, recent proposals from Kahnemuyipour (2004) and Kratzer & Selkirk (2006) and others (e.g., Adger 2006, Legate 2003, Sato 2006) argue that sentential stress patterns are related to phase patterns. Since phases are a means to synchronize derivational cycles, this recent work can be seen as a revival of the

claim of Bresnan (1971). The theory developed in Chapter 3 takes these proposals one step further with the idea that the identity and size of phases themselves are defined (at least partially) by IS. This provides a reconciliation of the ideas of Bresnan (1971) with some of the empirical counterarguments used against her by Berman & Szamosi (1972), Lakoff (1972), and Bolinger (1972), who essentially point out examples where IS changes the effects noted by Bresnan. In other words, if we expect (following Kahnemuyipour and others) that phase structure determines the placement of nuclear stress, and that in turn IS affects the location of phases in the derivation, then the fact that IS affects nuclear stress follows automatically.

A further advantage of this hypothesis is that it creates a close IS-prosody correspondence, without needing to use explicit IS markers that are interpreted at PF. The alignment of nuclear stress with certain IS categories essentially comes "for free." If this hypothesis turns out to be true, it represents a major advance by offering a formal explanation for why stress and information are related.

However, this proposal does not come without a cost. Chomsky's (2000, 2001) notion of "phase" is motivated by syntactic facts, and any change to the system of phase-construction must deal with those facts. The solution is fortunately a relatively simple one, which nevertheless has very interesting implications. While I claim that the need for IS partitions at LF constitutes an interface requirement for phases of appropriate sizes and locations, I also claim that this is not the *only* interface requirement on phases. I argue that in order for Diesing's (1992) Mapping Hypothesis to be evaluated at LF, it should make certain requirements on phases. I furthermore argue that unlike the IS

requirements, which vary considerably from sentence to sentence, the Mapping Hypothesis requirements are stable, and are indeed at the exact places hypothesized by Chomsky (2000, 2001). This means that ultimately, the effect of my IS-based phase hypothesis has little or no negative impact on previous work which assumes the CP and *v*P phases of Chomsky (2000, 2001). Better yet, my theory provides an additional reason for why these constituents should be phases in the first place.

This leaves working out the details of the IS-PF relation to Chapter 4. Prior to this chapter, some discussion of phonology is unavoidable for the sake of clear exposition, and the phase-based proposal in Chapter 3 already establishes the primary analysis of Chapter 4. Nevertheless, Chapter 4 reviews the relevant empirical details to be explained, and presents an analysis that proceeds from the theories developed in Chapters 2 and 3 to show how the IS partitions *via* phases and IS instructions *via* lexical items can give rise to the full range of intonational patterns that match the various IS patterns.

My theory is that there are essentially two paths of indirect interface between PF and IS. The first is the phase-based mechanism of generating IS partitions, which independently affects stress assignment, as discussed above. In Chapter 4, this idea is developed further, especially in combination with the hypothesis regarding the phase-based interpretation of the Mapping Hypothesis. In particular, I show that some of the previously mysterious alignments between Information Structure, tripartite semantic structures, and nuclear stress find a unified and parsimonious explanation, which falls out naturally from the theory developed thus far.

The second path relating IS and PF is through the "instructions" of IS, which are represented in boundary tones at PF. I propose that these boundary tones are instantiated as lexical items, in a way similar to Steedman (2000a, 2000b). This proposal raises important questions, such as where these boundary tone lexical items are located in the syntactic structure. I essentially claim that they are merged into the complementizer domain and linearized by PF to occur at the edges of intonational phrases. The details of this proposal are given in Chapter 4.

Finally, Chapter 5 concludes, by summarizing the theory, discussing some of its wider implications, and raising further questions raised by this work for future research.

1.6   Preview example

This section presents an extremely simple example of a derivation in order to give a preliminary overview of how the proposed theory works. The purpose is not to motivate or justify the system, but to give a quick snapshot of how the pieces fit together, before the following chapters develop them in turn as outlined above.

The discourse context for this example is a discussion about a little black dog named Schatzi. The speaker utters the following sentence, in order to inform the hearer of another of Schatzi's qualities:

(6)   Schatzi likes CHEESE.

                 H* L-L%

In terms of other theories, the NP *Schatzi* in (6) is the topic, theme, background, or old information, and the VP *likes cheese* is the focus, rheme, comment, or new information. For my theory, I coin the terms Information Frame (iFrame) and Information Core (iCore), respectively. In more descriptively explicit terms, *Schatzi* is the element linking the utterance to the discourse (preventing it from being a *non sequitur* or out-of-the-blue utterance), and *likes cheese* is the element that the speaker is trying to contribute to the discourse (and presumably to the hearer's knowledge, if the speaker is trying to be informative).

Since one of the goals of this dissertation is to test whether a formulation of IS that does not violate the T-model is possible, I will be assuming a version of the Minimalist syntactic theory in the tradition of Chomsky (1995). In this general model, the syntactic structure of a sentence begins with Numeration, the selection of lexical items from the lexicon as an unordered set. The elements in the Numeration are given in (7) below.

(7)   {Schatzi, cheese, likes, L-L%}

The first three words in this set presumably need no explanation, but the last ("L-L%") does. It represents the falling intonation contour at the end of the sentence. The presence of a so-called "boundary tone" (in the terminology of Pierrehumbert (1980), from which the symbol is borrowed) as a lexical item is unconventional, though not without precedence. Steedman (2000a, 200b) also treats boundary tones as lexical items, and the

theory here attempts to draw on this insight. Of course, the precise motivation and function of this choice is addressed in the chapters that follow. For the time being, it is sufficient to note that this contour encodes the relevant IS instructions.

IS instructions represent how the speaker intends the information in the sentence to be merged with the discourse representation. In this case, the instructions are to add the semantic value of the constituent in the iCore to the list of values that can apply functionally to value of the constituent in the iFrame. This is merely a complex way of saying that this is a simple declarative sentence, which intends to add some information to the discourse, and this is indicated by the L-L% contour.

Once the Numeration is done, the derivation begins, applying the Merge operation to pairs of items from the Numeration, which creates new objects that are added to the Numeration and made available for future Merges. In the case of our example, the first Merge is between *cheese* and *likes* to form the VP *likes cheese*, which is then added to the Numeration.

(8)   {Schatzi, L-L%, {cheese, likes}}

At this point, the system designates the unit {cheese, likes} as a phase, which is then sent off to PF and LF for interpretation.[5] This unit can still be accessed for further Merges, but the individual elements cannot be accessed, because the process of "packaging" the

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[5] The details of exactly why this unit is a phase in this derivation are discussed at length in later chapters, especially Chapter 3. In short, the "decision" of where to create phases is arbitrary in the syntax, and constrained at the LF interface. I claim that other sentences may have different phase articulations, but that these will simply result in ill-formed phases at the interface, or as sentences with different IS's.

phase has essentially fused the words into a single, atomic unit, as far as the syntax is concerned. Chomsky (2000) calls this property the Phase-Impenetrability Condition, and its details are reviewed in Chapter 3.

The issue of main relevance here is what happens when this phase is sent to PF and LF, respectively. At PF, stress is assigned. The stress assignment algorithm, the details of which are left to Chapter 4, assigns greater stress to *cheese* than to *likes*.[6] At LF, this initial phase is interpreted as the abstract property in (9), and given the status of iCore.

(9) λx (likes (x, cheese))

This status is assigned in an automatic, "dumb" way by the system, simply because it is the first phase to be sent to LF. More precisely, it is a phase that does not contain another iCore, and so it is designated as the iCore. Again, full justification and motivation for these principles are given in the following chapters, but in brief, every utterance requires an iCore, because every utterance must have at least a nominal reason for the speaker to say it, which is the contribution to the discourse, the iCore. Therefore, as phases are sent to LF for interpretation, the designation of iCore is assigned first.

Next, *Schatzi* is Merged into the specifier position with the phase {cheese, likes}, and finally the contour L-L% is Merged with the rest of the sentence into a high, abstract operator position (probably between C and the specifier of T), because of its status as an

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[6] The algorithm is essentially a Nuclear Stress Rule similar to the "null theory" of Cinque (1993), applied cyclically at each phase.

IS operator which defines the IS instructions over a domain. In other words, the meaning of the boundary tone, which is an operation mapping the meanings of informational units to discourse functions, applies over the informational units in its domain (the CP). The completed sentence is packaged again as a phase and sent to PF and LF. At LF, the denotation of this phase is mapped to the iFrame unit as given in (10).

(10)   λP (P (Schatzi))

The iFrame's value is essentially the semantic value of the sentence, with a variable in place of the iCore. In this example, it is an abstraction of the individual *Schatzi* that relates to some predicate. Intuitively, this means the meaning of the iFrame is something like "something is true about Schatzi", while the meaning of the iCore, given above in (9), is something like "someone likes cheese."

At PF, stress rules apply again. Again, we are ignoring the details of the algorithm until Chapter 4, but the crucial point here is that because the iCore is always submitted more frequently to the stress assignment cycle (once as the first phase, and twice as part of the second phase), it always ends up with greater stress. The fact that the iCore (more traditionally labeled the "focus") gets primary stress does not need to be stipulated in the theory, nor does it need an overt marking (like [+F]) in the syntax. If we assume that phases correspond to IS partitions, and that stress is assigned cyclically to each phase, in parallel to the cyclic application of syntactic rules at each phase, then the connection between focus and stress falls out as a natural product of the system.

Here the derivation concludes, and we are left with several objects. On the PF side, we have a string of phonological words, with the greatest stress on the word *cheese*, and an intonational boundary tone contour that PF linearizes to the end of the sentence. On the LF side, we have the overall proposition (the LF representing the entire sentence), the iCore and iFrame partitions of the proposition, and the IS instructions provided by the boundary tones, given in (11), (12), (13), and (14), respectively.

(11)   Proposition: likes (Schatzi, cheese)

(12)   iCore: λx (likes (x, cheese))

(13)   iFrame: λP (P (Schatzi))

(14)   IS Instructions: Map the value of the iCore into the properties that are true of the value of the iFrame (i.e., assert that *likes cheese* is a property of *Schatzi*).

Taken together, these elements mean that the truth of the sentence depends on the truth of the proposition that Schatzi likes cheese, and that the speaker is asking the hearer to modify their knowledge of the active discourse element *Schatzi* by adding the property *likes cheese*. This implies both that the hearer has an active representation of Schatzi in mind, and that the fact that she likes cheese is a novel piece of information. If the hearer in fact does not have an active mental representation of Schatzi (i.e., the conversation was about something else entirely), the sentence will be perceived as a *non sequitur*. If the fact that Schatzi likes cheese (or the denial of that fact) is already active in the discourse, then the sentence will be perceived as a redundant and awkward retreading of old ground, like a speaker plainly asserting the color of their own shirt, which is in plain view of the

hearer. The sum total of these elements appears to match the true state of affairs of the actual data for this simple example.

1.7   Summary

The rest of this dissertation is dedicated to fleshing out (and hopefully making sense of) the basic system illustrated in the example outlined above. To summarize, the theory developed here aims to explain data in which prosodic structure (*via* IS) appears to affect truth conditions, as in the "scope inversion" data given in (2) and (3). I aim to accomplish this by means of a thorough treatment of the semantics, syntax, and phonology relating to IS. In terms of semantics, I hypothesize that the truth-conditional effects are best explained by IS partitions and instructions superimposed on a general LF. In the syntax, I argued that standard F-marking and stress-based theories of IS violate the T-model in a critical and unrecoverable way. I claim that this conflict is resolved if phase theory is reformulated to correspond to IS partitions. In the phonology, I hypothesize that the combination of lexically-chosen tonal contours along with the natural product of stress rules applying cyclically to phases will provide the correct pairings of prosodic patterns and Information Structure, without violating the architecture of the T-model. To conclude this chapter, the overall structure of the proposal is given in Figure 1-3.

Figure 1-3: Schematic representation of the present theory

Begin derivation with a lexical array (including boundary tones)

{*Schatzi*, *likes*, *cheese*, L-L%}

Apply Merge (at will)

Merge (*likes*, *cheese*) = {*likes* {*likes, cheese*}}

Complete a phase
(subject to interface conditions)

{*likes* {*likes, cheese*}}

Stress rules apply to phase at PF

"likes CHEESE"

Phase is assigned an IS category (iCore
or iFrame), depending on whether the
phase contains another iCore or not.

iCore: *likes cheese*

Continue process cyclically until all phases complete

CHAPTER 2

INFORMATION AND TRUTH

2.1   Overview

The goal of this chapter is to develop a theory of Information Structure (IS) and its

interface with truth-conditional semantic interpretation, in order to account for a wide

range of data where differences in IS apparently give rise to different truth conditions.

But before this can be accomplished, a few preliminary tasks must be completed.

Section 2.2 aims to clarify the domain of what is meant by "Information Structure" in this

dissertation. Section 2.3 reviews some key general concepts from previous research.

Sections 2.4 and 2.5 review the specific theories of Steedman (2000a, 2000b) and

Vallduví (1992), respectively. Section 2.6 outlines my proposal for a novel theory of IS,

and sections 2.7 through 2.11 apply this theory in the analysis of critical data, particularly

data in which IS has apparent truth-conditional effects. Section 2.12 concludes the

chapter.

2.2   Defining Information Structure

Understanding IS requires us to look at language in the context of actual discourse and

discourse participants. Some aspects of language may exist independent of

communication (cf. Chomsky 1995), but it cannot be denied that a primary function of

language is the exchange of information. Information can be defined as adding to the

knowledge store of the recipient, henceforth referred to as the "listener". If I do not know

what the weather is like outside, and you tell me, "it's raining," then I have received

information. We will set aside philosophical issues about whether this kind of

linguistically-transferred information truly counts as "knowledge" (you may be lying to

me about the rain, after all),[7] and simply assume that any propositional content that

conveys meaning not already represented in the listener's knowledge store is information.

Following Chafe (1974), Vallduví (1992), and others, I assume that Information

Structure is a kind of "packaging" of information. That is, an utterance may contain

information regardless of how it is uttered, but the IS of that utterance is a means to

present that information in different ways. For example, the proposition represented in

(1) can be packaged in various ways, as shown by the differences between the discourse

functions of the utterances in (2)-(4).[8]

(1)   likes (Schatzi, cheese)

(2)   Schatzi likes CHEESE.

(3)   Schatzi LIKES cheese.

(4)   SCHATZI likes cheese.

One standard way of illustrating that these have different informational packaging is by

showing that these are appropriate answers for different questions. Only (2) is an

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[7] For example, "knowledge" implies the truth of the proposition. So it is strange to talk of my gaining the "knowledge" that it is raining if you tell me it is but are lying (intentionally or not). "Belief" might be a better word, but is also somewhat inaccurate, because your telling me that it is raining does not mean that I believe you. Since we will soon sidestep the idea that Information Structure is about *objective* information, these interesting discussions are somewhat moot for our current purposes.

[8] Recall that CAPS indicate primary (or nuclear) stress.

appropriate way to answer the question, "what does Schatzi like?" Similarly, "what does Schatzi think about cheese?" can only be answered felicitously with (3), and "who likes cheese?" can only be answered felicitously with (4).

This is not to say that IS is never ambiguous. On the contrary, most sentences with so-called "default" stress patterns are multiply ambiguous in their IS. For example, (2) could be a felicitous answer to any of the following questions:

(5)   What does Schatzi like? Schatzi likes CHEESE.

(6)   What do you know about Schatzi? Schatzi likes CHEESE.

(7)   What did you learn today? Schatzi likes CHEESE.

The standard analysis for this ambiguity is that there are rules that locate the main stress within the new information, but that for certain structures, informational constituents of different sizes may end up having stress assigned in the same place. The details of this situation will be addressed more fully in Chapter 4. For now, the point is simply that IS is not always disambiguated by the surface (phonological) string, and therefore the listener does not always have a trivial job in reconstructing the IS intended by the speaker.

This point raises a kind of general paradox about the nature of IS. Information in the absolute sense above is always defined in terms of the recipient, or the listener in the case of spoken language. "Schatzi likes cheese" is only informative in this absolute sense if the listener does not already know that Schatzi likes cheese. However, as a property of

a spoken sentence, IS is necessarily defined by the speaker, not the listener, and the speaker does not have full access to the knowledge of the listener (unusual and science-fiction circumstances notwithstanding). So in truth, IS is only approximately related to actual information, a point to which we will return later.

What kind of approximation is IS? I will again follow Vallduví (1992) in assuming that IS is essentially a set of instructions or suggestions to the listener on how they should update their knowledge store. If a speaker utters (8), they are assuming that the listener knows about John and his murder trial and that he wore a shirt there, and they are instructing the listener to add the property *pink* to their knowledge of John's shirt at his murder trial.

(8)   John wore a PINK shirt to his murder trial.

This set of discourse instructions has two essential components: the informational instructions themselves, and the units they apply to. For example, the informational units of (8), and the instructions that apply to them can be labeled descriptively and relatively pre-theoretically as follows:

(9)   Informative unit: *pink*

(10)   Non-informative unit: *John wore a shirt to his murder trial.*

(11)   Instructions to listener: Find your mental representation of the shirt that John wore to his murder trial, and add the property *pink* to it.

These descriptions are still informal, but before we can refine them into more formal definitions, we must consider how previous researchers have formulated these notions. The next section will review some of the primary insights gleaned from previous research.

2.3   Defining the primitive partitions of IS

The vast literature dealing with Information Structure is plagued with enormous variety in the formulations of how IS is partitioned, and equally enormous confusion in the terminology (see Kruijff-Korbayová & Steedman 2003 for a concise inventory of the most common terminologies and their historical dependencies). Some of the more common dichotomous terms include theme vs. rheme (Ammann 1928; Mathesius 1929; Firbas 1964; Halliday 1967; Steedman 1991, 2000a, 2000b), topic vs. comment (Strawson 1964; Chomsky 1965; Dahl 1969, 1974; Reinhart 1982), presupposition/open-proposition vs. focus (Akmajian 1970 (1979); Chomsky 1971; Jackendoff 1972; Prince 1981, 1984, 1986), narrow vs. wide focus (Selkirk 1984; Rooth 1985; É. Kiss 1998), and ground vs. focus (Vallduví 1992, Vallduví & Engdahl 1996). It should also be noted that there is a many-to-one mapping between terms and concepts in both directions in this literature, creating a confusing terminological picture. Sometimes similar or identical concepts are given different terms. For example, the "theme-rheme" concept discussed below is called "theme-rheme" by Steedman (1991, 2000a, 2000b), but is essentially parallel to the use of other terms by other authors, such as "ground-focus" (Vallduví

1990), "topic-focus" (Büring 1995, 1997), et cetera. At other times, similar terms are used to refer to distinct concepts. For example, Halliday (1967), Reinhart (1982), Büring (1997), and Sgall (1967) all use the term Topic to mean somewhat different things. The discussion that follows attempts to distill the concepts and ideas behind the various proposals, using some of these terms as cover terms, rather than attempting the quixotic task of clarifying and distinguishing all the various terms and their multiple uses in the literature.

In essence, the various proposals boil down to the following primary claims, which I will discuss in turn in this section:

1. IS articulates "new" vs. "old" information
2. IS Topics represent "aboutness"
3. IS represents connections to the discourse ("theme-rheme")
4. There is a distinction between types of Focus ("informational" vs. "contrastive" or "identificational")

In addition, there are two important recent attempts to capture several of these claims at once, namely Steedman's (2000a, 2000b) two-dimensional theme-rheme and background-focus theory, and Vallduví's (1992) hierarchical tripartite link-focus-tail theory. These two theories will be reviewed in more detail in sections 2.4 and 2.5, respectively. The rest of this section will deal with the four general claims listed above.

One basic way of defining IS is that it divides the utterance into "new" vs. "old" information. So in (2), repeated here as (12), the old information (in the reading of the sentence that answers the question in (5)) is that Schatzi likes something, and the new information is that what she likes is cheese.

(12)   [old Schatzi likes] [new CHEESE.]

This simple intuition about the function of IS categories turns out to be not quite right, or at least not sufficient. For one, defining exactly what is meant by "new" is difficult. For example, it is clear that the "new" element need not be new to the discourse, which is easily demonstrated if the context question for (12) is "does Schatzi like cheese, lettuce, or onions?" One could say that while *cheese* in this case is not strictly "new" (it has been mentioned already), the information that it is the thing Schatzi likes is new, but that is twisting the term a little too much to be useful. The designation of "old" information is similarly problematic.

A related notion is the formulation (e.g. Chomsky 1971) that substitutes "presupposition" for "old information". The idea is that the non-new partition of the sentence is presupposed, so that if *cheese* is the new information in (12), the proposition "Schatzi likes *x*" is presupposed. However, as pointed out by Jackendoff (1972), this does not hold up to examples like (13), where *nobody* is the new information.

(13)   I saw NOBODY at the party.

Clearly, it cannot be the case that "I saw *x* at the party" is presupposed by this utterance, because that would produce a contradiction. Revising what is meant by "presupposition" to fit with these cases necessarily takes the teeth out of calling it a presupposition in the strict sense of entailment, and so this notion cannot be quite right, either.

Another way of framing the IS articulation is that sentences include a Topic (roughly the same as the "old" information), which establishes what the sentence is "about" (Strawson 1964; Gundel 1974; Reinhart 1982). In complement, the Focus or Comment of the sentence is what contributes some kind of information in relation to the Topic. Theories forwarding this notion usually give data from clefting (often called "topicalization") paradigms such as the following.

(14)   [$_{Topic}$ Schatzi] [$_{Comment}$ likes CHEESE.]

(15)   [$_{Topic}$ CHEESE,] [$_{Comment}$ Schatzi LIKES.] (…LETTUCE, she HATES)

In this framework, sentence (14) is "about" Schatzi and makes the comment that she likes cheese, and sentence (15) is "about" cheese and makes the comment that Schatzi likes it. The primary difficulty with Topic-based theories is that they typically either assume (falsely) that the initial element of the sentence is always a Topic (Halliday 1967),[9] or

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[9] Take a dialogue like the following:

      A: Who do we know that likes cheese?
      B: SCHATZI likes cheese.

(footnote cont'd on next page)

else the diagnostics for determining the Topic are problematic at best (Ward 1985;

Vallduví 1992).   The utility of basing the IS partitioning around a vague "aboutness"

feature is therefore suspect.

Some theories (e.g., Reinhart 1982) tie the notion of Topic to more of a discourse

function. Reinhart (1982) uses a file card metaphor, similar to the File Change Semantics

of Heim (1982), in which discourse functions are described as retrieving and entering

information on file cards. She claims that Topics are the "addresses" of the file cards, so

that in a sentence like (15), where *cheese* is the Topic, it is basically an instruction for the

listener to locate the card with the address "cheese" and enter the information that Schatzi

likes it. However, this particular use of Topic has less to do with the "aboutness" notion,

and much more in common with the theme-rheme notion and the theory of Vallduví

(1992), both reviewed below.

The theme-rheme distinction[10] is explicitly about discourse function, as opposed

to notions like "aboutness" or "newness". In the words of Steedman (2000a), the theme

is "that part of an utterance which connects it to the rest of the discourse (p. 655)." The

rheme is the part that is a contribution to the discourse in some way. While this

characterization obviously overlaps a great deal with notions such as "newness" or

"aboutness," it is somewhat sharper and much closer to the true function of the IS

Schatzi is clearly the "new" information or "focus/comment" of the sentence uttered by B, while still
sentence initial. It is not clear that any definition of "aboutness" that allows Schatzi to be both a topic and
focus/comment is desirable or even coherent.

[10] Again, this notion can be found in a great deal of work, regardless of whether it is referred to as "theme-
rheme." I use these terms because they are used by Steedman (2000a, 2000b) in more or less the way I
describe them here. Vallduví's (1992) ground-focus distinction is essentially the same.

articulation as discourse related. The theme-rheme distinction is based on discourse function rather than informational status in some absolute sense.

As mentioned earlier, IS is not about "information" in the technical sense of providing new knowledge to the listener, because the speaker is the one responsible for structuring IS, and the speaker is not (usually) a mind-reader capable of knowing exactly what counts as information for the listener. Therefore, IS is much more accurately about the *intended* information. That is, because the speaker cannot directly access the listener's knowledge store, they can only make assumptions about what the listener knows and suggestions about how to alter that knowledge. This necessarily grounds IS in inter-speaker discourse, not in some objective sense of "new" vs. "old" information, what the sentence is "about," or other notions that depend on classifying the function of the IS partition in some absolute sense.

The final general claim from the literature listed above is that there appear to be different kinds of Focus. Roughly speaking, Focus is the element corresponding to "new" information, the rheme (intended contribution of the speaker to the listener's knowledge), the "comment" on the Topic, and so on. Several researchers (É. Kiss 1998; Vallduví & Vilkuna 1998; Steedman 2000b) have argued that there are at least two different types or degrees of Focus, which I will refer to as Informational Focus (I-Focus) and Operator Focus (O-Focus).

I-Focus is essentially the same as the concept of rheme discussed above. It is a purely informational notion, and is defined as the part of the utterance that the speaker intends to contribute something novel to the knowledge of the listener. This is called

"rheme" by Vallduví & Vilkuna (1998) and Steedman (2000a, 2000b), and "informational focus" by É. Kiss (1998). In contrast, O-Focus is conceived of having more of a quantificational (i.e., variable-binding) nature, that is closely related to the logical semantics of the utterance. Vallduví & Vilkuna (1998) call this "kontrast", Steedman (2000a, 2000b) uses the term "focus", É. Kiss (1998) refers to it as "identificational focus", and it is often referred to in other sources as "narrow focus." Some of the distinguishing characteristics called on to argue that O-Focus is a different animal include:

1. O-Focus creates an "alternative set" (or "context set"), which certain focus particles (e.g., *only*, *even*) or adverbials (e.g., *always*, *sometimes*) depend on for their semantics.

2. O-Focus has a contrastive or even exclusive character.

3. O-Focus takes scope like other quantificational elements, and can interact in scope judgments with regular quantifiers.

The classic example of the necessity of an "alternative set" notion comes from so-called "association with focus" phenomena (coined by Jackendoff 1972), analyzed famously in the Alternative Semantics framework by Rooth (1985, 1992). An example paradigm is given in (16)-(18) below.

(16)   John only eats meat on TUESDAYS.

(17)   John only eats MEAT on Tuesdays.

(18)   John only EATS meat on Tuesdays.

The critical issue with these data is that the semantics of *only* is bound up in the identification of (O-)Focus, which changes the truth conditions. The reading in (16) is that John is a vegetarian every day except Tuesdays, the reading in (17) is that John is a complete carnivore on Tuesdays, and the reading in (18) is that the only thing that John does with meat on Tuesdays is eat it. So if it is also true that John eats meat on Wednesdays, (16) is false, but (17)and (18) could still be true. If it is true that John eats vegetables on Tuesdays as well as meat, then (17) is false, but (16) and (18) could still be true. And finally, if John packs and sells meat on Tuesdays as well as eating it, then (18) is false, but (16) and (17) could still be true.

It is worth noting that although the ideas of I-Focus and O-Focus are distinct, they often turn out to overlap completely in any given utterance, especially in English, where they are both marked by stressed words or phrases. Some of the stronger evidence for truly distinct O-Focus comes from languages like Hungarian and Finnish (É. Kiss 1998; Vallduví & Vilkuna 1998). In Hungarian, postverbal word order is fairly flexible, but preverbal word order is defined very rigidly in terms of several operator "slots" (É. Kiss 1987). Some of these slots are designated for particular kinds of quantifiers (e.g., existential quantifiers get one slot, universal quantifiers get another; Szabolsci 1997), but the immediately preverbal slot is designated for (O-)Focus (Horvath 1986; É. Kiss 1998). Constituents in this special Focus slot get an exhaustive reading that is more than simple "new" information. As (19) shows, this special kind of Focus can interact in scope judgments with quantifiers.

(19)   a.   [$_{FP}$ JÁNOS   [$_{VP}$ köszöntött   mindenki-t.]]
                  János   greet.PAST   everyone-ACC
                  'It was János who greeted everyone (no one else greeted everyone).'
                  Focus > ∀

       b.   [$_{DistP}$ MINDENKI-T   [$_{FP}$ János   [$_{VP}$ köszöntött.]]]
                  everyone-ACC   János   greet.PAST.
                  'For every person, it was János (no one else) who greeted them.'
                  ∀ > Focus

In both (19a) and (19b), *János* 'John' is in the Focus slot, getting an exhaustive reading similar to an *only* phrase.[11] In (19a), the Focus takes wide scope over the universal quantifier *mindenkit* 'everyone', giving the reading that János was the only (relevant) person to greet everyone, allowing for the possibility that others did in fact greet some people, just not all of them. In (19b), the universal quantifier takes wide scope (by appearing in the preverbal slot for universal quantifiers, which is higher than the Focus slot), producing the reading that János was the only person doing any greeting at all, because for every person, János was the only person to greet them.

     This special Focus slot in Hungarian is somewhat independent of I-Focus, because new information can occur in a variety of positions, including postverbally. However, O-Focus must always be contained in the I-Focus of an utterance, so they are not completely independent. In any case, the existence of a special slot for O-Focus that is distinct from the syntactic positions in which I-Focus can occur is taken as evidence that there is a real distinction between a purely informational Focus and an operator-like

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[11] Indeed, *only*-phrases (*csak*-phrases in Hungarian) **must** occur in the Focus position (É. Kiss 1987, 1998), providing further evidence that there is something operator-like about this position.

Focus. In Chapter 3, I argue that this division is not as deep as it appears, and while it is obviously an important difference in the way Focus manifests itself, the differences observed are due to external factors (either semantic or pragmatic), and are not relevant for separating I-Focus and O-Focus into different IS categories.

To summarize this section, there are several different apparent dimensions that come into play in the partitioning of IS. On the one hand, there are tendencies to view IS categories as referring to objective aspects such as "newness" and "aboutness", but on the other hand, IS appears to be defined in terms of relating utterances to the broader discourse. Finally, there is some evidence of an additional non-informational dimension to Focus, which shows properties of being an operator of sorts. In the following sections, the specific proposals of Steedman (2000a, 2000b) and Vallduví (1992) will be reviewed, to contrast with the general observations discussed here.

2.4   Steedman

Steedman (1991a, 1991b, 1996, 2000a, 2000b, 2003) develops a detailed and powerful theory of Information Structure within his general Combinatory Categorial Grammar framework (henceforth, I will refer to Steedman's overall approach as *SIS*). While the theory proposed in this dissertation differs from SIS in many critical details, they also share many concepts, and so it will be useful to compare the two theories in some detail. This section presents a general review of the IS framework developed in SIS, concentrating on what the primitives of IS are, and how they are defined and used in SIS.

The syntactic framework of Combinatory Categorial Grammar (CCG) is significantly different from the syntactic framework assumed in this dissertation. A detailed discussion of these differences is deferred until Chapter 3, but in short, CCG employs a flexible means of assigning phrase structure, with the strong claim that this flexible phrase structure is isomorphic with Information Structure and intonational structure.

As a richly developed theory, SIS has a great deal of important details which are relevant to our purposes here. This section will concentrate on discussing the aspects of the theory concerned with the form and content of the IS primitives. SIS claims to be a two-dimensional theory of IS, but in fact, it appears to be somewhat more than that. The admitted dimensions are theme-rheme and background-focus, but additional theoretical constructs such as "commitment" and "agreement" are also introduced into the theory. Each of these aspects will be reviewed below.

The first dimension in SIS is the theme-rheme dimension, which matches closely with the discussion of theme-rheme in the previous section. Namely, the theme is conceived as an utterance's link to previous discourse, and the rheme is some kind of contribution or furthering of the discourse. However, although these units have discourse-related definition, in the presentation of the theory, SIS uses certain kinds of pitch accents as diagnostic of the theme-rheme status of a constituent. At this point, a short excursion is needed to discuss the phonological theory of intonation assumed by SIS, and used descriptively throughout this dissertation.[12]

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[12] A more detailed discussion of intonational structure is given in Chapter 4.

The phonological inventory of intonational contours used in SIS essentially follows the autosegmental tradition of intonational phonology (Liberman 1975; Pierrehumbert 1980; Pierrehumbert & Beckman 1988; Silverman et al. 1992; Gussenhoven 1983; Selkirk 1984, 1995; Truckenbrodt 1995; Ladd 1996). In this tradition, an intonational contour is composed of a series of tones (H or L), which have varying status in terms of how they are aligned with the lexical and metrical content of utterances. In the typology of tones, there is a basic distinction between pitch accents and boundary tones. A pitch accent is an intonational event that is usually realized as a local pitch excursion (i.e., peak or valley), and is aligned with primary stress. Pitch accents are said to be associated with words (and by extension, constituents) themselves, and there are several distinct varieties of pitch accents, distinguished by their contour and alignment with stress. Notationally, pitch accents are indicated with a "*". They can be simple, as in L* and H* for low and high pitch-peaked accents, respectively. They can also be complex, in which case they are notated with a "+" connecting the tones, as in L+H* or L*+H, which represent pitch accents that rise from a low to high tone. The "*" is used to mark the alignment to primary stress, such that L+H* is a pitch accent that starts low and peaks high around the nucleus of a strong metrical stress, and L*+H is a pitch accent that also starts low and moves high, but for which the low tone is the one aligned with stress.

Unlike pitch accents, boundary tones are not associated with particular words, but with entire IS units (theme or rheme), and manifest themselves (at least in English) typically as pitch contours at the ends of phrases, which are not aligned with stress in any

way. There is a distinction between so-called "boundary tones" and "phrase accents."

Major boundary tones are designated with a "%" and phrase accents are marked with a

"-".[13] Phrase accents may occur alone at the end of "minor" intonational phrases, but

boundary tones are always accompanied by a preceding phrase accent, forming a kind of

tonal compound. For example, the notation L-H% represents a combination of a low

phrase accent and a high boundary tone, and manifests as a phrase-final rise in pitch. The

symbol L-L% is a low intermediate phrase tone following by a low boundary tone, and

manifests as a phrase-final fall to the bottom of the speaker's pitch range (cf.

Pierrehumbert 1980; Pitrelli, Beckman, and Hirschberg 1994). For the purposes of SIS,

only the X% tones are of interest in the boundary tone cluster, but both are given in the

examples that follow for the sake of clarity and completeness.

SIS claims that some pitch accents are inherently "theme accents", and that others

are inherently "rheme accents". Steedman (2000b) admits that the empirical phonetic

basis for this distinction is controversial, but for the sake of exposition, we will simply

note that in SIS, L+H* accents are considered theme accents and H* accents are rheme

accents.

The function of the theme is to provide what SIS calls a "rheme alternative set",

which is "presupposed" in a very restricted sense of being presupposed to exist in the

discourse, or the listener's knowledge model. For example, in (20), the theme *Anna*

married provides a rheme alternative set including some of the items listed in (21).

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[13] Some sources including Pierrehumbert (1980), Gussenhoven (1984), and Steedman (2000a, 2000b) do not use the "-" convention for marking boundary tones, and instead leave them unmarked. In using it, I follow the ToBI conventions (Silverman et al. 1992; Pitrelli, Beckman, and Hirschberg 1994; Hirschberg & Beckman 1994).

(20)   [theme Anna married] [rheme MANNY]

(21)   Anna married Frank
        Anna married Joe
        Anna married Gustav
        etc.…

The notion of "presupposition" here means that the speaker is assuming that the listener has a representation for "Anna marrying" in their knowledge model. The membership in this rheme alternative set is constrained contextually, often by some extra-grammatical process such as general pragmatics or encyclopedic knowledge. For example, it is likely that in constructing the alternative set of individuals that Anna could marry, those individuals are selected from the set of eligible marriage partners, though discourse context could easily expand or restrict this set even further (perhaps there are only three eligible suitors under discussion).

This general notion of creating an alternative set has figured prominently in other theories of IS, mostly in the Alternative Semantics approach (Karttunen & Peters 1979; Rooth 1985, 1992; Kratzer 1991; Büring 1995, 1997; etc.). The idea is that by uttering a theme, the speaker is making the overt assumption that the rheme alternative set defined by that theme already exists in the listener's knowledge store. As SIS points out, sometimes this set does not exist already for the listener, in which case it can be "accommodated" in the sense of Lewis (1979). This can often be used as a rhetorical tool, as in the following:

(22)   Speaker A: What do you think of the president's new proposal?

Speaker B: [theme The president's idiotic new proposal] [rheme is sure to fail.]

In effect, Speaker B is asking Speaker A to find a representation of "the president's idiotic new proposal" in their knowledge store, which is a backhanded way to suggest that the listener should think that the president's proposal is idiotic (whether they do or not, and whether the speaker believes the listener does or not).

As a side note and preview of the analysis to come, the theory I defend in this dissertation agrees with SIS on this general use of the theme. We disagree on the phonological details of theme diagnosis, and the terminology is different, but the content of SIS's theme is very similar to the proposal for the iFrame in my theory.

The second dimension of IS partitioning in SIS is the background-focus distinction. This distinction is overlaid on top of the theme-rheme distinction, such that both the theme and rheme can (and often do) have separate backgrounds and foci. The key example used by SIS to illustrate this is the following (from Steedman 2000b:107):

(23)   Q: I know that Mary envies the man who wrote the musical. But who does she ADMIRE?

A: (Mary   ADMIRES) (the woman who DIRECTED   the musical)

Background   *Focus*   *Background*   *Focus*   *Background*

Theme   *Rheme*

The notion of "focus" here is very similar to the "O-Focus" notion discussed in the previous section, although SIS does not characterize it in operator-based terms. Rather, the notion SIS uses to characterize this "focus" is a contrast of some kind, though not necessarily "new" information. For example, *admires* is a focus inside the theme[14] *Mary admires* because it contrasts with the earlier theme *Mary envies*. Similarly, returning to the dialogue in (22), if Speaker A resented the underhanded use of *the president's idiotic new proposal* as a theme, she might very well follow up with:

(24)   Well, I think that the president's INTELLIGENT new proposal could WORK.

$$\underbrace{\underbrace{\text{Background}}\;\underbrace{\text{Focus}}\;\underbrace{\text{Background}}}_{\text{Theme}}\;\underbrace{\underbrace{\text{Bkgrd}}\;\underbrace{\text{Foc}}}_{\text{Rheme}}$$

In this way, Speaker A would contrast their theme with the previous theme (*the president's idiotic new proposal*), in order to return the backhanded comment from Speaker B.

The background plays a similar kind of role as the theme did, by representing alternative or contrast sets regarding the focus. For example, if the sentence in (24) had been uttered in a different context, the statement might be viewed as eliciting a focus alternative set (defined by the background of the theme) of "the president's *x* new proposal", where *x* could be any number of things. Under this reading, (24) could be interpreted to claim that out of the range of new plans by the president, the plan of the

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[14] This kind of structure is what authors such as Büring (1995, 1997) would call a "contrastive topic".

president that is *intelligent* could work, implying that the president's other non-intelligent plans might not. Drawing on this alternative reading of (24), Speaker B could continue the verbal sparring as in (25).

(25)   Really? And which plan is that? I didn't know he had any intelligent ones.

In any case, the larger point here is that the background provides similar kinds of alternative sets as the theme does. For the theory developed in this dissertation, this is an important observation. In short, I argue that what SIS captures in the theme-rheme vs. background-focus distinction is essentially levels of embedding of the same notion. That is, rather than theme-rheme and background-focus representing two orthogonal dimensions of IS, I claim that they should be represented as a single dimension that allows multiple embedding, similar in some ways to the "structured meaning" approach of Jacobs (1991) and Krifka (1991). The apparent distinction between these two dimensions in SIS is derivable from other properties of the present theory. This will be argued for directly later in this chapter (section 2.6). For now, it is sufficient to note that SIS intends a more qualitative distinction between these notions.

In addition to the theme-rheme and background-focus articulation, SIS introduces two other factors into the IS representation. One is the notion of "agreement", and the other is the notion of "ownership." SIS[15] argues that whether or not the speaker labels the utterance as "agreed" or "non-agreed" plays an important role in IS. SIS is careful to

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[15] The AGREE feature is not argued for directly until Steedman (2002, 2003).

note that a speaker may mark something as "agreed" or "non-agreed", independent of

their actual beliefs, but the basic idea is that by using an "agreed" structure, the speaker is

claiming that the speaker and listener both share belief in the information. To augment

this further, SIS annotates IS units in terms of whether the speaker or the listener is

committed to the proposition in the utterance. Again, SIS connects these options to

different choices in pitch accents (and we will again put the phonological details off until

Chapter 4), so that H* accents are seen as "agreed" and L* accents are "non-agreed", and

H% boundary tones are the listener's responsibility and L% boundary tones are the

speaker's responsibility. The following paradigm contains examples adapted from

Steedman (2003:7-8):

(26)　　H: You appear to be rich.
　　　　　S: I'm a MILLIONIARE.
　　　　　　　　　　H*　　　L-L%
　　　　　S committed to an agreed rheme

(27)　　H: You appear to be poor.
　　　　　S: I'm a MILLIONIARE.
　　　　　　　　　　L*　　　L-L%
　　　　　S committed to a non-agreed rheme

(28)　　H: Congratulations. You're a millionaire.
　　　　　S: I'm a MILLIONIARE?
　　　　　　　　　　H*　　　L-H%
　　　　　H committed to an agreed rheme

(29)　　H: Congratulations. You're a millionaire.
　　　　　S: I'm a MILLIONIARE?
　　　　　　　　　　L*　　　L-H%
　　　　　H committed to a non-agreed rheme

The idea is that in addition to theme-rheme (which tells the listener what they should activate and/or modify in their own knowledge) and background-focus (which tells the listener whether and where there is some contrast with an existing theme or rheme), IS provides a way for the speaker to mark the theme or rheme as (for example) a rheme that the listener is committed to, but about which there is not an explicit agreement between the speaker and listener.

What this approach shares with my theory is that a critical function of IS is to orient informational units in terms of the speaker's and/or listener's beliefs (or virtual, presumed beliefs). In addition, we agree that the content of tones, especially boundary tones, plays an important role in determining how this orientation works. However, we disagree in virtually all of the details. For one, it is not clear at all that SIS has the right set of mappings from tones to instructions, and many of the tonal distinctions critical for the theory have a less-than-robust empirical basis. More to the present point, the distinctions that these tonal units are supposed to represent do not seem to line up right in all circumstances, nor does SIS clearly spell out how different implicatures and pragmatic uses are derived.

For example, in both (26) and (28), the speaker is claiming that both speaker and listener agree, and the only difference is whether it is attributed to the listener's commitment or the speaker's. Logically, these would appear to be equivalent ("you're committed, and I agree" vs. "I'm committed and you agree"), but Steedman (2003) claims that these carry very different pragmatic weight. Namely, in the "listener committed with agreement" cases, the fact the speaker does not explicitly commit opens

the door for implications of doubt. While this perhaps makes a certain amount of sense, it seems strange that so much circumlocution is built into the system. For one, we would expect more occasions in which the answer in (28) means more literally that the listener is committed and the speaker actually agrees, rather than always using "agreement" to somewhat paradoxically express doubt, or possible disagreement. Consider (30):

(30)   A: I really think the Bears should have won the Superbowl.

        B: The BEARS should have won
                  H*   L-H%

As the theory is framed, the utterance by Speaker B should be able to straightforwardly assert that the listener (Speaker A) is committed to the idea that the Bears should have won (which is clearly true in this context), and that Speaker B agrees. However, in reality, this utterance is always taken to be an expression of doubt or disbelief on the part of Speaker B, which is clearly the case in (30), which comes across as an echo question, where Speaker B can is in utter disbelief that Speaker A just uttered the previous statement.

        While Steedman's (2003) rationale makes some sense, and ultimately captures the expression of doubt, it is questionable that the circuitous route of pragmatic reasoning that he proposes is the obligatory reading, even for contexts that would readily support a reading more obviously in line with what the SIS theory claims for the function of this contour. The sheds some doubt over the utility of the functions that SIS proposes for the various tonal contours.

In summary, the so-called two-dimensional approach of SIS appears to encode at least four independent factors in IS, making for a very rich and interesting theory. The theme-rheme distinction captures the basic notion discussed in the previous section, whereby the theme connects the utterance to the discourse, and the rheme contributes some development to the discourse. The background-focus distinction is used to further articulate within theme and rheme, allowing for the creation of additional alternative sets to allow for both theme-internal and rheme-internal contrasts. Further varieties of pitch accents and boundary tones allow the speaker to assert both 1) whether the proposition encoded by the given IS unit is a commitment of the speaker's or the listener's, and 2) whether there is agreement between the speaker and listener regarding the belief in that proposition. SIS claims that these factors give rise to a rich and complex variety of pragmatic inferences, but I argue that these fairly baroque inferences are not necessary, and that it is surprising and suspicious that circuitous inferences always take precedence over more straightforward or literal interpretations that should be available given the theory.

Despite these objections, SIS captures several important features shared with the theory developed later in this chapter. First, alternative sets are a natural consequence of both theme and background articulations. Second, background-focus structures are nested inside theme-rheme structures. Third, the relation between the informational units and the beliefs of the speaker and listener is a fundamental aspect of IS articulation. Finally, these speaker-listener relations are (usually) encoded in tonal contours, especially boundary tones.

2.5   Vallduví

My theory also owes a great deal to the theory of IS developed by Vallduví (1992) and

Vallduví & Engdahl (1996) (henceforth *VIS*). We will be not quite as concerned with the

details of VIS as we are with the details of SIS, but the larger insights of VIS are just as

important. The two most fundamental insights are 1) that IS represents a "packaging" of

information (following Chafe 1974), and 2) that these packages receive "instructions" for

the listener to use in order to integrate the information into their knowledge and/or

discourse representation.

      For VIS, the "packaging" notion is captured by the use of true structure in terms

of constituent structure to describe the IS partitions. This is in contrast with many more

"standard" theories (Jackendoff 1972 and following) in which IS is a distribution of

labels rather than a structure of its own. The packages themselves are also tied to certain

"instructions" for how the listener should incorporate the information into their

knowledge and/or discourse representation.

      VIS, like SIS, claims that a standard dichotomy is not enough to capture the range

of IS articulations. The partitions in VIS have a hierarchical nature. At the "top" level,

the distinction is drawn between "ground" and "focus", which corresponds very closely

to the conception behind SIS's theme-rheme distinction. The ground is further divided

into "link" and "tail". This scheme is represented in (31) below.

(31)   Utterance
                    Ground   Focus
              Link   Tail
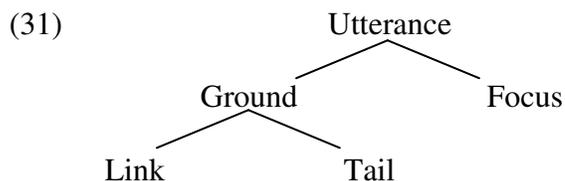
VIS uses the metaphor of a filing card system (similar to Reinhart 1982 and Heim 1982),

in which cards have "addresses" and "entries." The link serves to identify the address of

the file card to be modified, the focus identifies the information that is to be added to the

card, and the tail qualifies the entry in some way.

        This tripartite system is motivated in an attempt to capture the range of different

partitions inspired by different dimensions, such as theme-rheme vs. topic-comment, as

discussed in section 2.3 above. However, it is not at all clear that the "tail" partition is

necessary, and it appears to be used mostly to argue for a fairly straightforward IS-

surface structure correspondence in Catalan, one of the primary sources of data in

Vallduví (1992). That is, by assuming a tail constituent that does not need to be

contiguous with the link constituent, VIS is able to maintain the claim that Catalan

represents IS transparently at its surface structure. However, since VIS also argues that

IS can be non-isomorphic with surface structure in other languages, it seems like weak

evidence to use an assumption that IS is transparent in Catalan to justify the need for a

third IS category. Furthermore, the notion that the tail indicates "how" the focus

information is added to the link's "card" is vague at best, and redundant and superfluous

at worst. An example from Vallduví (1992) is given below.

(32)   [_{link} The boss] [_{focus} HATES] [_{tail} broccoli]

VIS's claim here is that the instructions are to retrieve the card for *the boss*, then enter in

the information that, regarding broccoli, he hates it. This does not appear to be

distinguished much if any from a partitioning that includes *broccoli* as part of the link, in

which the listener is instructed to find the card that represents the boss's relationship with

broccoli, and enter the information that he hates it. Since it is unclear how these

possibilities differ, the motivation for the tail itself is unclear, and probably stems from

VIS trying to avoid the complexity of non-contiguous IS constituents.

If there is a difference at all, it would seem to be that an all-link partitioning

would imply that the listener indeed had an available representation of the abstract

concept "the boss's relationship with broccoli." This seems to be borne out somewhat by

the examples, because (32) does indeed sound more felicitous when it is following a

context where the boss's relationship with broccoli is under discussion. This observation

provides evidence that a distinct "tail" partition is not only unnecessary, but perhaps ill-

advised on empirical grounds.

Despite the apparently unnecessary "tail" division of ground, VIS captures an

important insight in characterizing IS as a combination of partitions ("packaging") plus

instructions as to how to integrate the content of the partitions into the knowledge of the

listener. We will return to this point in the presentation of the present theory below.

VIS also makes an interesting claim regarding the IS-LF relationship, which I

nevertheless reject. VIS claims that IS is wholly independent of LF, and claims in fact

that IS derives from surface structure, in parallel with LF, but is distinct from it. VIS's

architecture therefore looks something like that shown in Figure 2-1:

Figure 2-1: VIS's model of grammar

articulatory-perceptual system   conceptual-intentional system
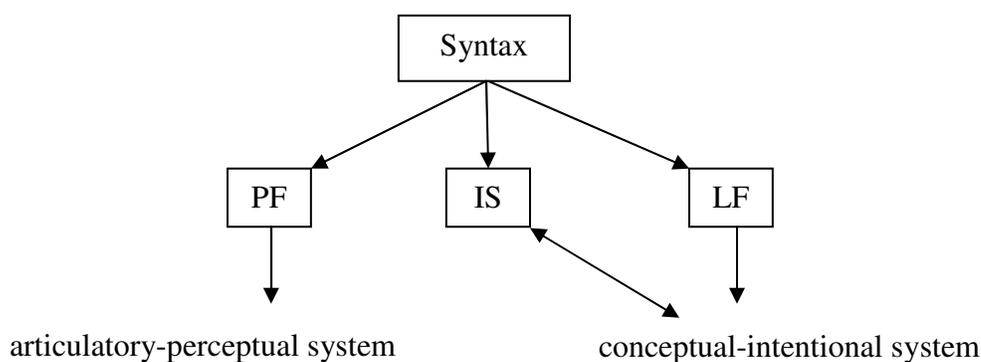
The claim is that while IS and LF both interact with the system of interpretation, they do

so in fairly delineated ways, such that LF informs truth conditions and denotative

semantics, and IS controls how those semantics are "delivered" to the listener.

However, there is something fundamentally flawed with VIS's view of the place

of IS in the grammatical architecture. Namely, it requires that semantic interpretation

(i.e., the mapping of hierarchical phrase structure into semantic structure via a

compositional semantics) be completely redundant. In VIS, IS is essentially a phrase

structure that is only somewhat modified from the surface structure of the sentence. That

is, it is a syntactic representation, whose constituents are interpreted as informational

instructions. However, the instructions themselves must operate on *semantic* structures

in order to be useful. For example, take our canonical sentence in (33) with an IS

partition as marked:

(33)   [link Schatzi] [focus likes CHEESE.]

In VIS, these partitions would act as instructions to find the file card for *Schatzi* and enter in the information that she likes cheese. The question this raises is how exactly these instructions identify the referent of "Schatzi" in order to locate the card, and how they provide the denotation of *likes cheese* in order to enter that information onto the card.

If the IS enters semantic structures onto the cards, then it must have access to semantic structures, which are presumably built at LF. If they are also built at IS, then LF, or at least the semantic interpretation component interfacing with LF, becomes strangely redundant. But there is no way for VIS to accomplish this, if IS is simply a permutation of surface structure. If the IS enters syntactic structures onto the cards, then there must be some *post hoc* system that comes by and provides semantic interpretations of the structures entered into the cards, which again seems redundant and unmotivated. In short, if IS works like VIS assumes it does (a set of discourse-linking instructions operating on IS units), then IS must be derived from LF itself. Figures 2-2 and 2-3 illustrate.

Figure 2-2: VIS's model of grammar
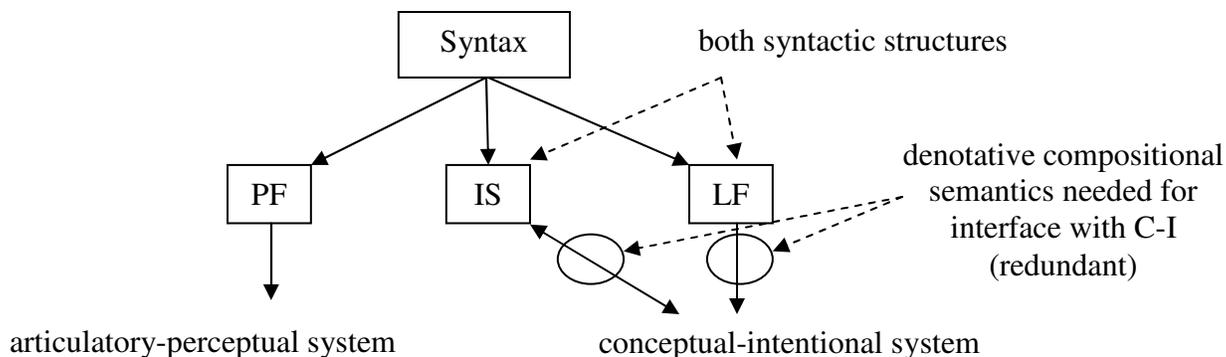
Figure 2-3: Alternative model of grammar (IS derived from LF)[16]
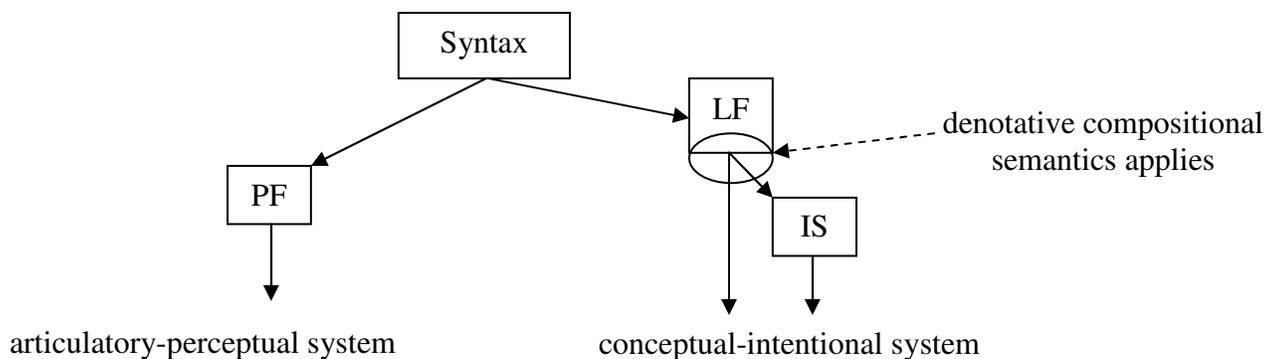
There is at least one important way in which the difference between Figures 2-2 and 2-3

is not trivial hairsplitting, which has to do with what kinds of structures we expect a

compositional semantics to operate on. In the model depicted by Figure 2-3,

compositional semantics operates on LF, which in the Minimalist Program (Chomsky

1995) is by definition the syntactic representation at which all semantically

"uninterpretable" features have been discarded. LF satisfies legibility requirements by

---

[16] I presume that LF and IS both interface with C-I, filling different functions. However, this point is somewhat orthogonal to the current issue of where IS stands in relation to LF.

consisting of only features that are interpretable at the semantic interface. If IS exists independently from LF, as in the VIS model depicted in Figure 2-2, then it too must independently satisfy the legibility requirements. In order to achieve this, the system would have to build in a great deal of redundancy, which is otherwise unmotivated. The assumption that IS "inherits" its semantic legibility from LF directly by derivation is a simpler one.

Ultimately, accommodating this revision to the architecture of VIS's theory does not change the theory much, and so much of Vallduví's insights can be retained. The choice to separate IS and LF seems to be more of a preferred ideological stance rather than a truly crucial theoretical stance for VIS. We should also note that accepting that IS must derive from LF does not admit the breakdown of the strong T-model hypothesis (cf. Figure 1-1), nor does it necessarily preserve it. The jury is out until the IS-syntax and IS-phonology relationships have been nailed down, as well.

In summary, VIS provides another interesting theory of IS, which emphasizes the notion that IS serves to partition the utterance into informational units, which are then subject to "instructions" to the listener as to how to incorporate the meaning of those units into their current knowledge representation. In this general regard, I follow VIS closely. VIS's system of informational categories is simpler than SIS's, but it still seems to contain an unnecessary and under-motivated notion in the division of the ground into link and tail. Finally, VIS intends to argue for a grammatical architecture in which LF and IS are clearly delineated, but if we are to follow the rest of their theory, including the

important notions of partitions and instructions, then maintaining this architecture

appears impossible.

2.6   The PII hypothesis

Now that we have reviewed some of the basic notions behind Information Structure, as

well as some of the details of two prominent recent theories of IS, we are ready to

propose the theory defended in this dissertation. The fundamental basis of the theory can

be captured in the following:

(34)   Partition-Instruction Independence (PII): Information Structure is composed of
        two primitives – partitions and instructions. The partitions provide semantic
        abstractions and alternative sets, and the instructions act as suggestions to the
        listener on how to operate on these semantic units in order to integrate the
        information of the utterance.

The PII hypothesis draws on the general insight that IS is fundamentally about linking

propositional content with the listener's knowledge store, an insight clearly inherited

from the SIS and VIS theories, as well as others. However, it makes the (as far as I am

aware) entirely novel claim that the partitions themselves are not necessarily bound to

any particular IS content.

        In prior theories, the partitions have always been identified with certain static

functions (topic-comment, theme-rheme, ground-focus, etc.). I suggest that one of the

reasons it has historically been so difficult to concisely characterize the functions of IS

partitions is that the functions are much more variable, and the partitions themselves

much more "contentless", than previously assumed. PII asserts that the partitions themselves are empty forms, made available for use by the system, but without any real preconceived definition of what their informational functions are.

The functions are defined by the instructions component, which is represented mainly by the phrasal tune (i.e., boundary tones). These instructions are typically similar to the kinds of instructions proposed by Vallduví (1992), in that they are relations between the denotative content of the IS partitions and the knowledge of the listener.

In order to capture this novel conception of IS partitions, I will give them novel terms, to help distinguish them from the legions of already confusingly similar IS terminology. The unit most commonly labeled as focus, rheme, or "new" information is called the Informational Core (or iCore), and the complement to the iCore (commonly labeled topic, theme, presupposition, ground, or "old" information) is called the Informational Frame (or iFrame). However, in a departure from typical partitioning structures, I require iFrames to *contain* iCores. For example, consider the traditional theme-rheme articulation and the corresponding Frame-Core articulation in (35) and (36), respectively.[17]

(35)   [theme Schatzi] [rheme likes CHEESE] L-L%

(36)   [Frame Schatzi [Core likes CHEESE]] L-L%

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[17] Here and throughout, I will continue to use SMALL CAPS to represent primary stress (pitch accent) and ToBI notation of crucial boundary tones. The full significance and relevance of these to the theory will be explained more in this chapter and in Chapter 4, but they are included now, in order to assist the reader in reproducing the data faithfully.

Notice primarily that while the theme and rheme are considered complements, the iCore is nested inside the iFrame. This has important effects on both the semantics and the syntax of this theory of IS. The motivation is in part structural, because it allows both iCore and iFrame to be limited to standard concepts of constituent structure. For example, in a more "standard" way of partitioning theme-rheme, the theme in (37) is not a syntactic constituent.

(37)   [theme Schatzi likes] [rheme CHEESE] L-L%

This result is easily integrated into Steedman's theory, because more generally than his theory of IS, Steedman (2000a, 2000b, etc.) defends the syntactic theory of Combinatory Categorial Grammar (CCG), which employs an inherently more flexible phrase structure which is capable of generating a phrase structure in which the theme *Schatzi likes* is a syntactic constituent. In fact, the very idea that IS corresponds straightforwardly to these "unorthodox" constituent structures is taken by Steedman as evidence for CCG.

However, if IS is structured as I am suggesting, in which iCores are properly contained in iFrames instead of acting as structural complements, then acceptance of CCG-like phrase structures is unnecessary. Furthermore, in the analysis of *only* in section 2.10 below, I provide evidence against the very division of constituents necessary to map a representation like (37) to constituents, contra the predictions of CCG.

The nesting of iCores within iFrames has semantic motivation as well, because it allows for the straightforward mapping of iCores to defined semantic units and iFrames

as abstractions with variables in place of the iCore, which will play an important role in interpretation of the units. This also makes it simple to obtain an iFrame value for an apparently "discontinuous" iFrame (i.e., one that has lexical content preceding and following the iCore), allowing for a simple structural way to represent the following, for example:

(38)   A: What kind of cheese does Schatzi like?

        B: [_{Frame} Schatzi likes [_{Core} CHEDDAR] cheese]
                                    H*   L-L%

The iFrame represents the notion connected to the previous discourse that Schatzi likes some kind of cheese (corresponding to the theme, background, etc. of other theories), and because it is represented as a bracketing over the entire sentence, it can do this without having to deal with any complex issues of composition, since it is not truly "discontinuous." But before we can proceed further, I need to define how the iCore and iFrame get their semantic values.

The content of the iCore is simply the compositional denotation of its parts – a "mini-LF" as it were. The content of the iFrame is also a compositional denotation, but is furthermore an abstraction where the iCore is replaced by a variable. For example, the sentence in (36) is composed of an iCore as given in (39) and an iFrame given in (40).[18]

(39)   iCore = *likes´cheese´*

---

[18] In the formulas throughout, italicized words with primes (´) represent the denotation of those words.

(40)   iFrame = λP (P (*Schatzi´*))

Note that simply by substituting the existential operator (∃) for the λ-operator in the

iFrame, we easily get the alternative sets and presupposition qualities that other theories

build in as primitives.

    The other component of the theory is the IS instructions that relate the iCore and

iFrame to the listener's knowledge. Strictly speaking, the IS instructions are not a

mapping directly onto the listener's knowledge, but rather a "suggested" mapping to the

listener's "virtual" knowledge. That is, I assume that during discourse, participants

project an image of their knowledge for the purposes of the discourse, because they are

unable (and often unwilling) to expose their actual knowledge unmediated to the other

participant. If participants are being extremely truthful and divulging a great deal, this

virtual image of their knowledge will look more and more like their actual knowledge.

However, this is not necessarily the case. In the end, this distinction has little effect on

the theory presented here; I mention it only for clarity and thoroughness.

    In any case, I assume that every utterance contains two types of instructions: a

LINK operation and an EDIT operation. LINK is a request for the listener to retrieve or

activate some individual, state, property, proposition, or other semantic structure. By

discourse convention, this structure will be one that is already related to the current

discourse, thus approximating the notion of "theme" or "topic". However, it is not

necessarily the case that LINK must be performed on something already active in the

discourse. In complement to LINK, EDIT is an operation that changes the information

associated with the structure retrieved by LINK. To use a database metaphor, LINK calls up an "entry" in the database, and EDIT changes some aspect of the data under that entry. Despite the implication of the name EDIT, often this will be simply an addition of information, and will not suggest any changes to the currently stored information.

Since the semantic value of the iFrame can be virtually any kind of semantic category, I do not mean to place restrictions on how the database entry is retrieved. This is in contrast to other "file card" metaphors (Heim 1982; Reinhart 1982; Vallduví 1992), in which the "address" of a file card has an explicit or implicit limit on semantic type, such as being an individual. Therefore, I imagine a kind of mental database, where it entries can be called up by any property, not just by individuals. However, working out the structure of this mental database in any further detail is beyond the scope of this thesis.

The exact content of these two operations is modified by lexical items in the utterance. I include boundary tones as lexical items for this purpose. Very often the only source of LINK and EDIT instructions will come from the boundary tones, but there are some words that also have effects, as we will see in analyses to come later in this Chapter.

In the next section, I will put this relatively simple theory to the task of accounting for a wide variety of data, emphasizing data in which different information structures appear to result in different truth-conditional readings. In the process, I will motivate the precise content of the instructions component of the theory.

2.7   Basic focus

First, I will analyze the basic cases of "plain" informational focus. Once again, consider

the following sentences, this time fully labeled with the PII model's articulations of iCore

and iFrame:[19]

(41)   [Fr Schatzi likes [Co CHEESE]]

(42)   [Fr Schatzi [Co likes CHEESE]]

(43)   [Fr [Co Schatzi likes CHEESE]]

(44)   [Fr Schatzi [Co LIKES] cheese]

(45)   [Fr [Co SCHATZI] likes cheese]

To be even more explicit, the semantic content of the units in (41) are as follows:

(46)   iCore: *cheese´*

(47)   iFrame: λx ((*likes´* (x))(*Schatzi´*))

The Frame can be paraphrased, "the things that Schatzi likes". In all of the examples

(41)-(45), the utterance ends with a L-L% contour. I propose that L-L% contours provide

the following instructions:

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[19] Henceforth, I will use the abbreviations Fr = iFrame and Co = iCore as bracket labels.

(48)   L-L% Contour Instructions:

      a.   LINK = retrieve the iFrame from K_H (the Listener's knowledge)

      b.   EDIT = add the iCore to the list of entities that evaluate true when combined with the Frame

The informal effect of these operations given the IS for (41), (46), and (47) is that the speaker requests the listener to find their representation of the property "liked by Schatzi" and add the individual *cheese´* to the list of individuals (or sets of individuals) that Schatzi likes.

Note that this does not refer explicitly to "active" discourse themes or topics. I assume that part of engaging in a cooperative discourse is using LINK to request entities that are relatively active already. This is analogous to playing football with someone and asking them to pass you the ball. While you could request that they pass you a ball that they left on the sidelines, in their car, or even at home, it is more polite and pragmatically clear if your request is for the ball that they are holding. Likewise, it is entirely possible, and sometimes rhetorically appropriate or advantageous, for a speaker to make LINK requests to entities that are not active (or even represented at all) in the listener's virtual knowledge. In most cases, however, it is more pragmatically sound and typical to LINK to active discourse themes.

For example, if someone asks "who around here likes cheese?" and your response is (41), which asks the listener to retrieve their concept of the things Schatzi likes, you are asking them to do more work than is necessary. It would be easier for the listener if you uttered (45), which would make the request that they retrieve the concept of "liking

cheese." This is pragmatically more felicitous since they already have that active because

of their question. Furthermore, the EDIT suggestion from (41) to add the individual

cheese´ to the set of things that Schatzi likes is also less than helpful, because the listener

really wants to add an individual (person) to the set of people who like cheese. Example

(41) indeed provides them with information in the absolute sense, and information they

requested at that, but the method of packaging and delivery – by means of the partitions

and instructions – is all wrong and unnecessarily cumbersome for the listener.

2.8   Meaning of L-H%

Before we proceed to the cases in which IS appears to have truth-conditional effects, let

us look at a different boundary tone with a different set of instructions. I propose the

following instructions for the so-called "continuation rise" L-H% contour:

(49)   L-H% Contour Instructions:

      a.   LINK = retrieve the iFrame´, where the iFrame´ = the iFrame, with $\neg\exists$ substituted for the λ-operator.

      b.   EDIT = add the iCore to the list of entities that evaluate true when combined with the iFrame (not the iFrame´)

Note that this definition leaves the EDIT instruction unchanged, and only modifies the

LINK instruction. It may be possible that there are some typological differences between

the types of lexical items that change LINKs and the types that change EDITs. I will

leave this issue aside for now, and continue with the analysis at hand.

Consider now the following sentence, along with its associated Core, Frame, and instructions, as per the definitions above:

(50)   [Fr [Co SCHATZI] likes cheese LH%]

(51)   iCore: *Schatzi´*

(52)   iFrame: λx ((*likes´*(*cheese´*)) x)

(53)   LINK: retrieve ¬∃x ((*likes´*(*cheese´*)) x)

(54)   EDIT: add *Schatzi´* to the entry for λx ((*likes´*(*cheese´*)) x)

The critical difference here from the previous analysis (besides a different iCore-iFrame articulation) is that the LINK is requesting the listener to retrieve the proposition that there is no individual that likes cheese. This of course strongly implies that the listener has this belief in their virtual knowledge.

This is a felicitous result, in a number of interesting ways. First of all, it allows a unified analysis for what appear to be two conflicting ways this contour is used. Consider the two following dialogues, which both use the same critical sentence:

(55)   A: No one I know actually likes cheese.

        B: That's not true. **SCHATZI likes cheese**
                            H*   **L-H%**

(56)   A: You know what I heard the other day? Schatzi likes cheese!

        B: What? **SCHATZI likes cheese**   Are you serious?
                  H*   **L-H%**

Let us call the critical contour the "counterexample intonation" in (55), and the "echo question" contour in (56). It turns out that these two utterance types are identical phonologically. Both can have either understated or exaggerated pitch peaks on *Schatzi* (though they both need primary stress there),[20] and they both have the same final pitch contour. However, they have apparently very different pragmatic effects. I argue here that the pragmatic differences exist only because of the different discourse context, not because they encode different information structures.

The apparent difference in these examples is that in (55), Speaker B is using the utterance to deny the assertion of Speaker A, whereas in (56), they are using it to try to confirm Speaker A's assertion while expressing some disbelief. In Steedman's (2003) theory, the "echo question" contour is the one given in (28), repeated here as (57):

(57)   H: Congratulations. You're a millionaire.
         S: I'm a MILLIONIARE?
                    H*   L-H%
              H committed to an agreed rheme

To refresh the reader's memory, the rationale from Steedman is that by asserting that the proposition is the *listener's* responsibility and by agreeing, the pragmatic effect is presumed to be an expression of doubt, since the speaker is not committing outright, but rather "second hand" by agreeing with the listener's commitment. This is baroque and not quite right intuitively, since the effect of disbelief does not appear that subtle.

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[20] In ToBI terms, the pitch accent on *Schatzi* can either be L+H* or just H*.

In any case, while Steedman (2003) has an analysis for the "echo question" case, it is unclear how he would accommodate the "counterexample" case in the theory. He would at least have to assert that the listener is the one committed to the proposition, but this seems wildly off from the facts, since the speaker is using this utterance to directly contradict the listener's previous statement. Presumably, Steedman (2003) would need to posit a significant intonational difference in order to explain the different discourse effects, but as noted already, it is extremely unlikely that any consistent phonological differences exist between the "counterexample" contour and the "echo question" contour.

The solution, of course, is that Steedman's (2003) notions of speaker/listener "commitment" and "agreement" are off the mark, because the product of the PII theory given here provides a neatly unified analysis for both. The "counterexample" pattern in (55) is most straightforwardly explained, because the LINK requests a retrieval of the proposition "no one likes cheese", which is exactly the proposition given earlier by Speaker A. However, the proposition suggested by EDIT clearly contradicts and revises the LINKed proposition, having the effect of providing a counterexample ("it can't be true that no one likes cheese, because (at least) Schatzi does").

The analysis for (56) is a little more circuitous, though arguably not as much as Steedman's. In this case, it is the LINK that is a contradiction to Speaker A's previous assertion. However, because this sentence is a direct "echo" of Speaker A (which is one of the necessary conditions for an echo question), the pragmatic effect is equivalent to saying "surely you don't mean what you just said." The assertion provided by EDIT further softens the harshness of the contradiction by repeating the assertion that was just

refuted by the LINK. In other words, by suggesting to the listener that the listener does

not believe their previous assertion, while the speaker asserts it himself, the speaker is in

effect saying, "I think I didn't hear you right. You couldn't mean what you just said, but

I'm going to reassert it anyway and give you a chance to confirm it, just in case you did

mean to say it." While this analysis is slightly convoluted, it nevertheless captures the

essence of an echo question extremely well, and it does so in a unified analysis that also

explains how the same intonational contour (and same underlying informational

structure) can have a very different "counterexample" reading as well. The main

difference between the two is the discourse context of Speaker A's assertions to which

Speaker B is responding. It makes sense that identical informational instructions could

result in very different pragmatic readings, given different discourse contexts.

Before continuing with further analyses, we need to take a closer look at a detail

that was glossed over in the presentation of this analysis. This detail is brought out better

by a different example of the "counterexample" contour. Take the following dialogue,

with the iCore, iFrame, LINK, and EDIT for the bolded sentence defined below:

(58)   A: Schatzi likes a lot of beverages, but she doesn't really like any food.

       B: [$_{Fr}$ **Schatzi likes** [$_{Co}$ CHEESE]]
                          H*   L-H%

(59)   iCore: *cheese´*

(60)   iFrame: λx ((*likes´*(x))(*Schatzi´*)

(61)   LINK: retrieve ¬∃x ((*likes´*(x))(*Schatzi´*)

(62)   EDIT: add *cheese´* to the entry for λx ((*likes´*(x)) *Schatzi´*)

The attentive reader will notice that the meaning of the LINK is to retrieve the

proposition that there is nothing that Schatzi likes. This would appear to contradict the

first clause (the "beverage" clause) of Speaker A's statement as well, because how could

Schatzi like beverages if she does not like anything? However, that is not the reading

that this dialogue produces. It seems clear that Speaker B is only trying to refute the idea

that Schatzi does not like food, and is not interested in claiming that Speaker A does not

actually believe that Schatzi likes beverages.

Similarly, Speaker B's use of the same utterance as an "echo question" falls flat in

(63), even though it would presumably have the same "you didn't mean what you just

said" effect as the utterance in (56) did, given that the value of the LINK is that Schatzi

does not like anything.

(63)   A: Schatzi doesn't like any kind of beverage.

         B: [$_{Fr}$ **Schatzi likes** [$_{Co}$ CHEESE]]
                               H* L-H%

So what is going on here? These apparent problems for the analysis so far are easily

resolved once we attend to the issue of how the ranges of variables in the iFrame are

determined. To wit, they are constrained by pragmatics and by encyclopedic knowledge.

This notion requires some explanation and justification. First of all, I am not

alone in positing this kind of influence of encyclopedic knowledge and pragmatics. All

standard accounts of any kind of Alternative Semantics (e.g., Rooth 1985, 1992; Büring

1995, 1997) assume that alternative sets are constrained heavily by such factors, so that the alternatives do not always range over every type-similar substitution. For example, in the sentence "Schatzi only likes CHEDDAR cheese," where there is an alternative set of "Schatzi likes *x* cheese," in most cases the alternatives to *x* will be other types of cheese (e.g., Stilton, Wensleydale), not just any type-matching lexical item available (purple, tiny, fresh, blind, angry), though this could be altered somewhat depending on the discourse context.

In terms of the previous analyses, in (58) and (63), when the LINK retrieves "there is no thing that Schatzi likes", the variable "thing" is likely constrained to food types, since the variable is replacing the iCore *cheese*. This is why the critical utterance does not imply a contradiction (or any kind of interaction, for that matter) with the assertions regarding Schatzi's tastes in beverages. By extension, this contextual restriction of alternative sets also explains why this same utterance can be a counterexample in the following dialogue as well.

(64)   A: Schatzi likes NOTHING.

         B: [Fr Schatzi likes [Co CHEESE]]
                                 H* L-H%

It also explains why (65) is somewhat nonsensical in any context.

(65)   [Fr Schatzi likes [Co NOTHING]]
                             H*   L-H%

In essence, the null set ("nothing") cannot be taken as part of an alternative set. In other words, even though the logical representation of the LINK of these sentences is essentially "there is no *x* such that Schatzi likes *x*", *x* is constrained so that it includes only entities, not null entities like the NP *nothing*. So even though *nothing* would fit the type of the variable in the LINK, it is not part of the alternative set. This restriction from null set alternatives is important for later analyses as well, and we will see some evidence elsewhere of implied existential operators, which I take to be a related phenomenon. There is something about the kinds of implicatures generated through information structure that prefers existential readings of variables. Perhaps this is one reason why there is so commonly presuppositional force behind iFrames, leading some researchers (e.g., Chomsky 1971) to divide IS into focus and presupposition.

Let us consider an additional example of how this process of constraining iFrame alternative sets works to provide often very subtle and interesting effects. The example comes from a line from the quirky, low-budget comedy film *Napoleon Dynamite*. The context is that one character, Deb, is trying to sell homemade crafts door-to-door. She is obviously very nervous and somewhat socially awkward, and at one point in her sales pitch, she mentions that she is trying to raise money to go to college. From off-camera, the character Kip delivers the following line (annotated for IS, primary stress, and tonal contour):

(66) [$_{Fr}$ [$_{Co}$ Your MOM] goes to college]
               L+H*   L-H%

Deb is perplexed and confused by this comment, and runs off in embarrassment. For our

purposes, this is an interesting additional example of the L-H% contour in use, as well as

an illustration of how iFrame alternative set constraint works.

The analysis here follows the same derivation as the previous L-H% analyses.

The result is that according to the LINK and EDIT as defined in (49), Kip has 1)

suggested that Deb retrieve the notion "no one goes to college" from her knowledge store

and 2) asserted that this is mistaken because in fact her mom does. The ultimate effect is

of an extremely odd insult, whereby one's mother going to college is treated as a negative

thing. How is this accomplished?

The insult effect has to do with how the range of alternatives to x in "there is no x

such that x goes to college" (the LINK) is defined. The basic intuition that this statement

should be an insult comes from the "your mom" trope of insult jokes. If Kip had chosen

a different subject (e.g., "Napoleon," "I," "my mom") there would have been little or no

effect of an insult, except to emphasize the fact that Deb is not in college, which is a

totally different effect from the line as given in (66). Such a comment might even be

considered a kind of encouragement (e.g., "I go to college, and so could you!"). But as it

stands, the "your mom" element serves to provoke the listener/target Deb into thinking of

it as an insult of some kind.

In order for the assertion to be an insult, the property of going to college must be

seen as a negative thing. Finally, this is where the alternative set restriction comes into

play. Since it is being implied that going to college is bad, the LINK "there is no x such

that *x* goes to college" is suggested more as "there is no (person of value) that goes to

college." In this way, the insult is extended to Deb, because it implies that her aspirations

of college are self-defeating because they put her in a negative category of people, which

also includes her mom. The true oddness of the comment comes from the fact that the

opposite opinion, that going to college is a very positive thing, is much more

conventional. The writer/director of the film reports that this line is taken directly from a

real-life experience, where the line was delivered by a member of a biker gang, directed

at a young rock musician who was addressing the crowd and mentioning that most of the

audience was in college. In this original context, it is much less strange that the speaker

has a negative outlook on the property "going to college." This analysis demonstrates

that subtle differences in discourse circumstances, such as an underlying perception that a

given assertion is meant to be an insult, can have fairly radical effects on the implications

generated by a given IS. However, it also shows that the analysis presented here is

capable of capturing these subtle differences in a relatively straightforward way, with a

relatively simple system of partitions and instructions.

Now that we have seen how the system works for basic kinds of informational

readings and how different intonational contours affect IS by modifying the informational

instructions, we are in a position to finally address the data of central interest to this

thesis, namely data in which IS appears to have truth-conditional effects. The pattern that

emerges is that rather than modifying LF directly, the IS articulation of LF provides a

rich source of pragmatic implication, which in turn partially drives preferences for

different readings. This allows us to maintain a picture of the IS-LF relation that is

consistent with the general T-model architecture.

2.9   Scope inversion with negation

So far we have only looked at examples where the iCore has been an NP, V, or larger

constituent. Consider the following example, where a determiner is the iCore.

(67)   [$_{Fr}$ [$_{Co}$ MY] home wasn't wiretapped]
           H*   L-H%

(68)   iCore: *my*

(69)   iFrame:[21] λD (¬ *wiretapped´* (D (*home´*)))

(70)   LINK: retrieve ¬∃D (¬ *wiretapped´* (D (*home´*)))

(71)   EDIT: assert (¬ *wiretapped´* (*my´* (*home´*)))

This example turns out not so different from what we have seen so far, as a fairly

straightforward "counterexample" case. The LINK instructions implies that the speaker

believes that all homes were wiretapped, and the assertion provides an exception to that

believe, by stating that the speaker's home was not wiretapped.

Things get somewhat more interesting when the determiner is a quantificational

element, such as the data mentioned in Chapter 1. Recall that in the following sentences,

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[21] I am perhaps simplifying the semantic representation somewhat. I am assuming here that the determiner D is a function that takes a bare noun (N´) as an argument and returns a value that can then be the argument of the predicate *wiretapped´*. Different ways of formulating the type of D should have no effect on the analysis as presented here.

the prosody, in particular the choice of boundary tone, appears to alter the relative scope

of negation and the universal quantifier:

(72)   [$_{Fr}$ [$_C$ EVERY] home wasn't wiretapped]
            H*   L-L%
        "For every home, that home wasn't wiretapped"   ($\forall\ \neg$)

(73)   [$_{Fr}$ [$_C$ EVERY] home wasn't wiretapped]
            H*   L-H%
        "Not every home was wiretapped"   ($\neg\ \forall$)

As we have seen, a difference in boundary tones translates to a difference in the LINK

instructions. I will now show how this difference drives the apparent preferences for

scope readings.

        First, let us analyze the "surface scope" example, in (72). It is repeated again

below, along with its IS partitions and instructions.

(74)   [$_{Fr}$ [$_{Co}$ EVERY] home wasn't wiretapped]
            H*   L-L%

(75)   Core: *every´*

(76)   Frame: λD ($\neg$ *wiretapped´* (D (*home´*)))

(77)   LINK: retrieve λD ($\neg$ *wiretapped´* (D (*home´*)))

(78)   EDIT: assert that D = *every´*

The analysis here is straightforward. The LINK essentially suggests for the listener to

find the notion of "which (or how many) houses were not wiretapped", and EDIT

instructs the listener that *every´* is the right number of houses that were not wiretapped. In other words, by treating "houses that weren't wiretapped" as a unit to combine with *every´*, the listener is biased heavily towards the wide scope universal reading.

The "scope inversion" case is somewhat more complicated. It is given again below, with its full IS articulation:

(79) [$_{Fr}$ [$_{Co}$ EVERY] home wasn't wiretapped]
       H*   L-H%

(80) Core: *every´*

(81) Frame: λD ($\neg$ *wiretapped´* (D (*home´*)))

(82) LINK: retrieve $\neg\exists$D ($\neg$ *wiretapped´* (D (*home´*)))

(83) EDIT: assert that D = *every´* in λD ($\neg$ *wiretapped´* (D (*home´*)))

Note that really the only thing that is different is the LINK. Now, instead of suggesting that the listener activate the representation of the kinds of homes that were not wiretapped, the speaker is implying that the listener believes that all of the homes were wiretapped. So why does this change in the LINK alter how the denotation for the assertion is interpreted? Again, we must appeal to the pragmatic implicatures that arise from the interaction of IS components.

First, I assume that in both this case and the previous case, the LF provides both scope options for the sentence. I will sidestep the thorny issue of exactly how different scopes are computed by LF, and simply assume that both scope options are available at LF, regardless of IS, since IS does not alter LF in any way. In this way, I follow previous

analyses of this phenomenon (Büring 1995, 1997; Krifka 1998; Martí 2001; Baltazani 2002), which have also analyzed the scope inversion effect as a product of IS, not strictly of LF.

Given that assumption, then we are left with a situation in which the speaker has implied that the listener believes that all homes were wiretapped, but then offered the contradiction of this by saying that "every home wasn't wiretapped," which either means that not all homes were wiretapped (allowing that some or even most were), or that none of them were. Pragmatically, the weaker choice (the "not all" option) is the better choice, for at least two reasons. First of all, by activating the implication that the listener claims that all of the homes were wiretapped, the speaker is making the contrast between "all" and "not all" the most salient, because that is the way to check the truth of this belief of the listener's. If this is the case, then asserting a single counterexample (i.e., non-wiretapped) home is sufficient to contradict the listener's belief, and asserting that every home was non-wiretapped is overkill. Assuming a pragmatic principle like Grice's (1975) Maxim of Quantity (be no more or less informative than required), this creates a preference for the "weaker" reading of "not every home was wiretapped."

The second reason that this reading is pragmatically preferred is that there are other more clear ways of asserting that none of the homes were wiretapped. For example:

(84)   [Fr Every home was [Co NOT] wiretapped]
                                  H*   L-L%

(85)   Core: *not´*

(86)   Frame: λN (N *wiretapped´* (*every´* (*home´*)))

(87)   LINK: retrieve λN (N *wiretapped´* (*every´* (*home´*)))

(88)   EDIT: assert N = ¬

This essentially says something like "the way that every home was wiretapped was not at all." By retrieving the abstraction of the wiretapping of every home, there is a bias to treat the wiretapping of each home uniformly, i.e., to give *every* wide scope. Note that this is still just a bias, not an absolute restriction on scope readings. But the point in regards to the "scope inversion" case in (79) is that with other methods of biasing a wide scope *every* reading, the pragmatic reasons to prefer a wide scope negation reading for (79) are magnified.

By invoking somewhat "fuzzy" pragmatic implicatures, this analysis takes on an appearance of a rationalization of the theory rather than a strong confirmation of it. However, this analysis makes just the right predictions, and has several advantages over previous theories. For one, previous theories have concentrated almost solely on the cases with explicit negation, as (74) and (79), and have not looked nearly as much at examples of the same IS without negation, as in the analyses in the previous section, e.g., (50). Thus, the PII theory developed here is able to provide a unified account of "counterexample" and "echo question" data, in addition to the "scope inversion" cases. The prominent analysis of the scope inversion data by Büring (1995, 1997) depends heavily on negation being present in the sentence, as does the analysis by Vallduví (1992). The theory presented here operates independent of the negation, though clearly

the presence of negation changes how some of the readings are taken. As a simpler approach that explains more phenomena, the theory presented here would seem to be at an advantage.

Furthermore, makes the right kind of empirical predictions regarding the source and strength of the "scope inversion" effect. It predicts that these utterances are still fairly ambiguous, which reflects the data. It also predicts that if something blocks the pragmatic inferences, the scope preference effects should disappear. One place to look for verification of this prediction is children's utterances and interpretations. Anecdotally,[22] there are examples in which children and their utterances seem immune to the "scope inversion" effects, and in fact tend to give "surface" scope readings in all cases, regardless. The limited, unpublished experimental work on this particular issue (Leddon 2003; Leddon et al. 2004; Jeffrey Lidz (p.c.)) has suggested the predicted null effects for children where adults appear to show more robust effects. More empirical evidence is needed, but clearly more efforts should be taken to control discourse and pragmatic factors than previous work, in addition to the more typical ways of eliciting scope judgments.

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[22] From my own daughter, as well as others. When she was roughly 2 ½ years old, my daughter produced the sentence:

i) EVERY pony isn't on the floor
   H*   L-H%

And she very clearly intended the "no ponies are on the floor" (the surface scope) reading. She was using the statement to contradict my earlier statement that some of her toy ponies on the floor. It is likely that she simply hadn't quite acquired the precise informational and pragmatic meaning of the L-H% contour. Because of that deficiency, the theory clearly predicts that the "scope inversion" effect would disappear, which it clearly did. Of course, this is anecdotal, and more controlled or rigorous methods of data collection on this issue are needed to provide a strong test.

Other empirical confirmation of this theory exists in data with different quantifiers in the Core. For example:

(89)   [$_{Fr}$ [$_{Co}$ SOME] homes weren't wiretapped]
                    H*   L-H%

(90)   [$_{Fr}$ [$_{Co}$ A FEW] homes weren't wiretapped]
                    H*   L-H%

By the analysis given above for the sentences with *every*, the L-H% contour for (89) is expected to give the opposite scope reading (i.e., narrow scope negation "there are some homes that were not wiretapped"). The reason the "scope inversion" effect should flip directions is as follows. The content of the LINK is still the same, whereby it implies that the listener believes that none of the homes were wiretapped. I argued above that pragmatically, asserting that this is false by small-scale counterexample is preferred to asserting that "all the homes were wiretapped" by asserting that in fact none of them were (the latter is overkill, *contra* the Maxim of Quantity). With the universal quantifier, this meant that wide scope negation ($\neg \forall$) should be preferred to narrow scope ($\forall \neg$). For the existential quantifier in (89), this is reversed, because the narrow scope negation ($\exists \neg$) is the preferred "weak" way of contradicting the claim that all of the homes were wiretapped.

The predictions for bias with other quantifiers, like *a few* in (90), are less clear. First of all, the available readings are more complex, since in different circumstances, "not a few" can mean either less than a few or more than a few, or even both/either.

Second of all, it is unclear whether any of the scope readings are antagonistic to the Maxim of Quantity, like the strong readings of the universal ($\forall\neg$) and existential ($\neg\exists$) are. So if there is any prediction at all for the pattern of bias for sentences like (90), the theory would appear to predict a mix, or perhaps a lack of bias altogether.

Interestingly, some recent experimental evidence is consistent with these predictions. In Jackson (2006), I report a production experiment in which subjects were forced to try to use prosody to disambiguate scope readings, as represented by different line drawings for sentences such as "every square hits a circle." Subjects were given a sentence to read aloud, and were instructed to try to bias potential listeners towards one scope reading or another. A sample item is given in Figure 2-2 below.

Figure 2-4: Sample item from Jackson (2006)
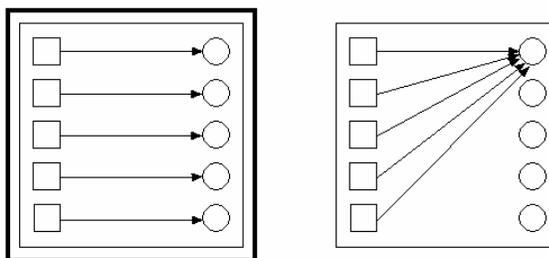
Every square hits a circle.

Each item had two of four operators (*every*, *a few*, *a*, and *not*), and all combinations and orders of these four operators were investigated. For the current discussion, only the sentences with negation are relevant. When looking at the incidence of final pitch rise, sentences with negation and *a* were much more likely to show a final pitch rise (L-H%)

for narrow scope negation ($\chi^2 = 8.47$, p<0.004), and sentences with negation and *every* were much more likely to show a final pitch rise for wide scope negation ($\chi^2 = 9.61$, p<0.002). Finally, sentence with *a few* and negation showed a very even distribution of pitch rises and falls for both scope conditions ($\chi^2 = 0.25$, p<0.62). This pattern of results is exactly as predicted by the analysis given above.

While an important prediction of this theory, this pattern of results is not uniquely predicted by the theory. In particular, Büring (1995, 1997) predicts exactly the same pattern of results, for very different reasons. In Büring's theory, the relevant notion is whether the alternative set generated by what he calls the "contrastive topic", when combined with the relevant scope reading of the sentence, leaves anything "disputable." For example, for a sentence such as (73), repeated here as (91), Büring's Topic Set would be something like (92).

(91) [$_{Fr}$ [$_C$ EVERY] home wasn't wiretapped]
       H*   L-H%

(92) Topic Set for (91): *Q home was N wiretapped*, where *Q* ranges over type-similar alternatives to *every* (e.g., *some*, *most*, *one*), and *N* ranges over type-similar alternatives to *not* (only negation or the lack thereof).

So other members of the Topic Set would include things like *most homes weren't wiretapped*, *most homes were wiretapped*, *seven homes weren't wiretapped*, *some homes were wiretapped*, etc. Büring (1995, 1997) claims that the contribution of the tonal contour is to require that something be Disputable in the Topic Set. Büring (1995, 1997)

provides a formal definition of what is meant by Disputable, but it boils down to a requirement that there must be something in the Topic Set that is neither entailed nor contradicted by the denotation of the base utterance (i.e., (91)). The $\forall \neg$ reading fails this requirement, because for any combination of quantifier and negation/non-negation, they will either state that some number of homes were not wiretapped (which is entailed by $\forall \neg$), or they will state that some number of homes were wiretapped (which is contradicted by $\forall \neg$). Because the $\forall \neg$ reading fails to allow Disputability, it clashes with the discourse requirements of the tonal contour, and so the $\neg \forall$ reading is preferred.

Because $\forall \neg$ and $\neg \forall$ are equivalent to $\neg \exists$ and $\exists \neg$, respectively, Büring (1995, 1997) also makes the same set of predictions as my analysis above regarding the reversal of scope inversion effects for existential quantifiers, and a lack of bias for quantifiers that are neither existential nor universal. However, given his theory as I have presented it here, there may yet be a way for future research to test the differences between these two analyses. Essentially, Büring's (1995, 1997) theory should treat all non-universal, non-existential quantifiers the same. My theory, however, predicts that the size of the bias in the L-H% contour cases depends on the size of the proportion encoded by the quantifier, all things equal. For example, my theory predicts that *most* should behave more like *every* than *some*, because refuting "all homes were wiretapped" with "not most (i.e., fewer than half) homes were wiretapped" should be pragmatically preferred to the assertion that "for most homes, those homes were not wiretapped." Intuitively, this seems to be the case, because (93) below appears to show the kind of inverse scope pattern as *every*, though perhaps not as strongly.

(93)   [$_{Fr}$ [$_{C}$ MOST] homes weren't wiretapped]
           H*   L-H%

      Preferred reading: 'It's not the case that most homes were wiretapped' (maybe just half of them were)
      Less preferred reading: 'The number of homes that were not wiretapped is most of them' (it must be less than half of the homes that were)

However, these kinds of judgments can be very muddy, so more convincing empirical evidence may have to wait for a more robust experimental investigation of such data. In any case, to the extent that quantifiers such as *most* show some amount of inverse scope bias with a LH% tonal contour, they constitute an empirical argument for my conversational implicature-driven analysis over Büring's (1995, 1997) Contrastive Topic and Disputability analysis.

In summary, this apparent truth-conditional effect of intonation can be given a straightforward analysis in the present theory, whereby different conversational implicatures arise from interactions with the IS articulations of these utterances. Furthermore, this analysis represents a unified treatment of apparently disparate phenomena, including scope inversion effects, counterexample contours, and echo questions. The differences between these phenomena ultimately reduce to the kind of discourse contexts that they find themselves in. Given the extreme phonological similarity between these phenomena, this unified treatment is a felicitous result.

2.10   *Only* and association with focus

Another well-known example of apparent truth-conditional effects of IS is the case of

only, as a so-called "focus sensitive" particle (Rooth 1985, 1992; Partee 1991). Perhaps

the most dominant analysis of *only* was developed by Rooth (1985, 1992), following and

further developing the insights of Jackendoff (1972). Rooth's approach goes by the name

of Alternative Semantics, because it emphasizes the alternative-inducing aspect of

focus.[23] In short, the analysis proposes that focus provides the semantic component with

access to an alternative set (*C* by Rooth's terminology). *Only* is given lexical semantics

that refer to this set, essentially saying that the alternative expressed in the focus is the

only alternative that results in truth of the expression.

        For example, if *cheese* is taken to be the focus of (94), then the alternative set *C* is

essentially the set of alternatives to cheese (meat, bread, ice cream, dog food, etc.), and

the sentence is taken to mean something like (95), paraphrased as "out of the entire set of

alternatives, if Schatzi likes something, that something is cheese."

(94)   Schatzi only likes [$_{\text{focus}}$ cheese]

(95) $\forall x\ (x \in C \land \textit{likes}(\textit{Schatzi}, x) \rightarrow x = \textit{cheese})$

In the PII theory developed in this chapter, Rooth's analysis could be carried over fairly

easily, since the semantic value of the iFrame is precisely the same as that provided by

Rooth's "context set" *C*. However, there is another option, which appears to be

---

[23] Remember, what is most typically called "focus" in the literature corresponds most closely to the iCore
partition in my theory.

preferable, both conceptually and empirically. The conceptual argument is based on the architectural issues that are the motivating force behind this thesis. In a Rooth-style analysis, the denotative semantics of *only* must access the informational notion of the iFrame (in Rooth's terms, the alternative set). As argued above regarding Vallduví's (1992) claim about the LF-IS relationship, LF must logically precede IS, in order to provide IS with denotative semantic structures to operate on. If those denotative structures themselves are dependent on IS categories, the relationship becomes a lot more circular and chicken-and-egg-like. The alternative is that instead of being an element which *depends* on IS, *only* is an element that *defines* IS. That is, it can be analyzed as something like an IS particle, which affects how the iCore is interpreted. This allows the LF-IS relationship to be unidirectional, which greatly simplifies the architectural picture.

More concretely, in terms of PII, *only* affects how EDIT is performed. Compare the "default" edit operation with the *only* edit operation below:[24]

(96)   Default EDIT: add the iCore to the elements that resolve with the iFrame to return a value of "true". Formally: iCore $\in$ C such that $\forall x: x \in C$, $\lambda y(iFrame(y))(x) = 1$

(97)   *Only* EDIT: replace all the elements that resolve with the iFrame to return true with the iCore. That is, if an element C returns true with the iFrame, that element is the iCore. Formally: $\forall x: x \in C$, $(\lambda y(iFrame(y))(x) = 1) \rightarrow x = iCore$

---

[24] The reference of truth value here raises the question of how questions are treated in this analysis, since it is not clear that questions return a simple truth value. Unfortunately, I can only dodge the issue here, by confessing that I have intentionally avoided discussing the IS of questions throughout this thesis, because the issues raised by such an investigation are in many ways orthogonal to the thrust of the current work. However, an analysis of questions should have a number of important implications for the theory as a whole, especially given that I have folded in an analysis of echo questions as derived essentially the same as an assertion. For the time being, though, this must be left for future research.

This is semantically nearly equivalent to Rooth's (1985, 1992) analysis. As argued above, this analysis has a slight conceptual advantage by placing the locus of effect squarely in IS, as opposed to requiring LF semantics to depend on IS representations.

However, there appears to be an empirical distinction between these two analyses, namely in the interaction between *only* and the L-H% rising contour analyzed in the previous section. A theory such as Rooth's (1985, 1992), in which the only relevant role of IS is to delimit the scope of *only*, has trouble explaining the oddness of the combination of *only* with the L-H% contour, as in example (98).

(98)   ?? [Fr Only [Co SCHATZI] likes cheese]
                      H*   L-H%

By Rooth's account, the semantics of *only* are purely dependent on Focus (here represented as the iCore), and so explaining the oddness of *only* in conjunction with the L-H% rise contour must find an independent explanation. In contrast, the strangeness of this sentence finds a natural and straightforward explanation in the theory presented in this chapter. In short, the instructions imposed on the LINK by the L-H% contour conflict with the instructions imposed on EDIT by *only*, both of which are given below:[25]

(99)   LINK: retrieve ¬∃x (((*likes* ⌢*cheese* ⌢)x)   "retrieve the proposition that there is no
            x that likes cheese"

---

[25] Because I am analyzing *only* as a discourse particle, it is not included in the denotative meanings of the iFrame or iCore. Rather, its meaning is represented by the EDIT instructions.

(100) EDIT: $(\lambda x \,.\, likes'cheese'x)(x) = 1 \rightarrow x = Schatzi'$ "if there is an x that likes cheese, that x is Schatzi"

The conflict here comes as a result of the conditional, almost existential nature of the EDIT instruction. The LINK asks the listener to retrieve the proposition that there are no individuals that like cheese, but then asks them to evaluate the conditional "if there is an x that likes cheese, then that x is Schatzi." Because of the LINK proposition, the antecedent of the conditional in the EDIT will return false regardless of the consequent, leaving the consequent irrelevant, and therefore pragmatically strange and unacceptable.

This explanation depends crucially on the claim that *only* has only discourse meaning, which therefore cannot be a denotative element of the iFrame. If this were not the case, we would expect that (98) would be a perfectly reasonable response to an assertion that there is no person such that only they like cheese. But that does not seem to improve on the oddness of (98):

(101) A: Surely there isn't only one person that likes cheese.

    B: ?? [Fr Only [Co SCHATZI] likes cheese]
                        H*   L-H%

Because B's response is still odd, it suggests that the L-H% contour does not interact with *only* in the same way as with other words. The analysis here is that *only* and the L-H% contour make competing assumptions about the discourse representation of the listener, which explains the pragmatic unacceptability of (98). This follows straightforwardly in a

theory in which *only* is represented as a discourse particle with an effect on how EDIT works, but without denotative semantics. It is unclear how a theory such as Rooth (1985, 1992), in which the denotative lexical semantics of *only* simply refer to an alternative set, can account for this pattern.

Interestingly, the sentence improves dramatically if an additional stress (with accompanying iCore and iFrame) is added:

(102)   [Fr Only [Co SCHATZI] [Fr likes [Co CHEESE]]]
                        H*   H*   L-H%

This example raises a number of interesting questions about how the iFrame/iCore structure maps to the syntax, which I will nevertheless postpone until Chapter 3. For now, it is enough to notice that unlike the simple cases such as (98), alternatives to *Schatzi* are expected. That is, (102) works best as a reply to an assertion like, "there is nothing that only one person likes," but just as in other uses of the L-H% contour, it implies the existence of alternatives as well, which normally *only* conflicts with. However, (102) works well as a "counterexample", which could be followed by other paired-reading counterexamples. For example:

(103) A: There's nothing that only one person likes.

     B: Sure there are!
        [Fr Only [Co SCHATZI] [Fr likes [Co CHEESE]]]
               H*   H* L-H%
        and [Fr Only [Co CORA] [Fr likes [Co BROCCOLI]]]
                   H*   H* L-H%
        and I bet there are others, too!

This data support my analysis, because it demonstrates that when the discourse-related conflict between *only* and the L-H% contour can be resolved, here through an additional iCore, the two elements are perfectly compatible.

Finally, it should be noted that while perhaps somewhat unusual, the existence of lexical items that only have an IS "meaning" is not unheard of crosslinguistically. Another prime example is the German response particle *doch*, which is essentially used to contradict a negative statement. For example, (105), but not (106), is an appropriate contradiction of (104), and (109), not (108), is an appropriate contradiction to (107).[26]

(104) A: Karl   ist   nicht zu   meiner   Party gekommen.
          Karl   is   not   to   my   party come.PSTPRT
          'Karl didn't come to my party.'

(105) B: Doch, er   ist   gekommen.
          no   he   is   come.PSTPRT
          'No, he did come.'

(106) B: # Nein, er   ist   gekommen.
          no   he   is   come.PSTPRT
          'No, he did come'

---

[26] PSTPRT marks the past participle form of the verb.

(107) A: Karl   ist   zu   meiner   Party gekommen.
              Karl   is   to   my   Party come.PSTPRT
              'Karl came to my party'

(108) B: # Doch, er   ist   nicht gekommen.
              no   he   is   not   come.PSTPRT
              'No, he didn't come.'

(109) B: Nein, er   ist   nicht gekommen.
               no   he   is   not   come.PSTPRT
              'No, he didn't come.'

Karagjosova (2006) analyzes *doch* as a case of contrastive focus, following a Rooth-style

analysis. She proposes that *doch* represents an entire proposition *p,* and is used to evoke

the alternative set of that proposition, which she takes to be $\{p, \neg p\}$. In terms of my

theory, through LINK *doch* requests the listener to access a negated proposition directly

relevant to the immediate discourse (i.e., usually the preceding sentence), and then

through EDIT asserts the positive version of that proposition as a contradiction. This

analysis explains how *doch* can also be used in the following apparently positive or

neutral contexts:[27]

(110) A: Das   war   sehr   freundlich   von   ihm.
              That   was   very   friendly   of   him.
              'That was very friendly of him.'

       B: Doch.
              'Yes.' (that was friendly of him)

---

[27] Data and judgments from Helbig (1988) and Karagjosova (2006).

(111) A: Willst   du Zucker   in   den Kaffee?
             want.2ndpers.sing you sugar   in   the coffee
             'Do you want sugar in your coffee?"

       B: Doch.
             'Yes.' (I do want sugar in my coffee.)

In (110), speaker B is actually affirming the assertion of speaker B. However, the effect

of *doch* is to imply a negative bias to speaker A's assertion, roughly parallel with the

English "wasn't that friendly of him?" This is predicted straightforwardly by the analysis

here, because speaker B is requesting speaker A to find a negated proposition relevant to

the previous assertion, which in this case is the assertion that it was not friendly of him

(to do whatever he did). Similarly, the response by speaker B in (111) implies that

speaker A's question had a negative bias (i.e., "you don't want sugar, do you?"). In this

regard, my analysis is parallel with the analysis by Karagjosova (2006), with the only

difference being that in my analysis, *doch* has a purely IS-based meaning, by affecting

how LINK and EDIT apply, while Karagjosova follows Rooth (1985, 1992) in assuming

that both denotative and "alternative set" semantics are required. That is, the differences

between my analysis and hers for *doch* in German parallel the differences between my

analysis and Rooth's for *only* in English.

2.11   Some additional cases

So far, I have presented analyses for two major cases in which IS appears to have an

effect on truth conditions, couched in the PII theory of IS developed in this chapter. I

have shown how the effects of the L-H% rise on the scope of negation, and the effects of

IS on the meaning of *only* can be derived from a general theory of IS that takes partitions (Core and Frame) and instructions (LINK and EDIT) as its primitives. However, there are several other cases of IS effects on truth conditions remaining.

Partee (1991) gives the most thorough to-date listing of these cases. While it is unfortunately beyond the scope of this dissertation to provide comprehensive analyses for each of the phenomena given there, I will provide additional analyses for some, and sketch brief suggestions for the rest.

2.11.1   "Modals", indefinites, and the Mapping Hypothesis

Partee (1991: section 2.2.5) gives the following examples, borrowed from Halliday (1970), who describes a hypothetical character in the London underground (subway) who sees the following sign and panics because he does not have a dog with him:

(112)   "Dogs must be carried."

Of course, the intended reading is equivalent to "if there is a dog, one must carry it", while the hapless character interpreted it as "one must have a dog to carry." The preferred reading of this ambiguous structure is the opposite in the following warning on a construction site:

(113)   "Safety helmets must be worn."

However, the biases to these sentences can change depending on where primary stress falls. For example:

(114) DOGS must be carried. (= one must have a dog to carry)

(115) Dogs must be CARRIED. (= if there is a god, one must carry it)

Partee (1991) sets these data up as an issue about modals, but I argue that in fact the IS is interacting with the bare plural subject, not the modal. Partee (1991) recognizes the connection, but does not claim that the modal does not play a role. She correctly points out that these examples are similar to data like the following, involving indefinites and the interaction between stage-level and individual-level predicates:

(116) TICKETS are available.

(117) Tickets are AVAILABLE.

(118) * TICKETS are expensive. (except in a contrastive statement)

(119) Tickets are EXPENSIVE.

Accounting for these data exposes a critical aspect of my general theory, but it will require an in-depth discussion of the IS-syntax relation, and therefore must be put off until Chapters 3 and 4. In short, the IS articulation interacts with where the indefinites are interpreted in the structure, and *where* they are interpreted affects *how* they are interpreted, as per Diesing's (1992) Mapping Hypothesis. My theory will show how an

integration between the Mapping Hypothesis and IS works, and how it gives rise to these and other interesting data.

2.11.2   Counterfactuals

Dretske (1972) points out the following contrast (addition of intonational contours is mine):

(120)   If Clyde hadn't married BERTHA, he would not have gotten the inheritance.

(121)   If Clyde hadn't MARRIED Bertha, he would not have gotten the inheritance.

Example (120) could be true in a world in which Clyde's inheritance depended on him marrying Bertha specifically as opposed to some other person, and example (121) could be true in a world in which Clyde's inheritance depended on him getting married to anyone at all.

Without going too deep into the semantics of conditionals and how IS interacts with them, the effect appears to be dependent on what the speaker is requesting that the listener LINK to. In (120), the LINK is to people for whom it is true that if Clyde had not married them, he would not have gotten his inheritance. In other words, the set of people he needed to marry in order to claim his inheritance. By asserting that Bertha is in that set, it is conversationally implied (via Grice's (1970) Maxim of Quantity) that there are at least some relevant people in the world that are not in that set. It would not be pragmatically felicitous to suggest that Bertha was in a set of people, if in fact everyone

(relevant) was in that set of people. This is still ambiguous between an exhaustive interpretation and a simply contrastive one, though the predicate *marry* certainly pushes the interpretation towards exclusivity. For example, the base assertion is that Bertha is in the set of people for whom if Clyde did not marry, he would not have received his inheritance. This does not rule out a polygamous requirement in which Clyde also had to marry other people as well. This is perhaps illustrated better with a different predicate:

(122)   If Clyde hadn't read *Syntactic Structures*, I wouldn't have considered him much
        of a syntactician.

In this example, it seems clear that I might have other reading requirements in mind, even though I am focusing on *Syntactic Structures* at the moment. Therefore, the predicted ambiguity is borne out in the data, although there may sometimes be a strong bias towards the exhaustive/exclusive reading.

   (121) finds a similar analysis. This time, the LINK is to the set of relations between Clyde and Bertha that would have to hold in order for Clyde to claim his inheritance. This also does not limit *marry* as the only relation possible between the two. Explaining how this example permits a reading where it is not strictly necessary that Bertha be the person that Clyde marries is a little trickier, because it appears to relate to how conditionals are judged. For example, in the conditional in (121), it is clear that Clyde has to be part of the picture, even if Bertha does not. That is, we can imagine a world in which (121) is true, where Clyde could marry any person to get the inheritance,

but we cannot imagine that there is a world in which any person could marry Bertha, and

Clyde would still get his inheritance. However, that appears to be a result of the fact that

it is Clyde's inheritance. Consider the following:

(123)   If Clyde hadn't SHOT the balloon, it wouldn't have popped.

In this case, it is the balloon that is the "non-negotiable" participant of the shooting

action, because clearly a reading of (123) is available in which it would have popped if

anyone had shot it. Therefore, it appears that a large part of determining the readings for

Dretske's (1972) examples depends on things other than IS. IS definitely has an effect,

through the introduction of the background assertion (e.g., the people Clyde needs to

marry, or the relations he must have with Bertha in (121) and (120) respectively), but it is

not the only thing that has an effect on these readings. In any case, the apparent effect

that IS does have is easily captured by my theory.

2.11.3   *Because*-clauses

The following examples illustrate another effect of the different IS functions of L-L%

and L-H% tonal contours:

(124)   I didn't marry her because she's RICH
                                                  H* L-L%

(125)   I didn't marry her because she's RICH
                                                  H* L-H%

The first sentence can be paraphrased "the reason I didn't marry her is that she's rich (because I couldn't stand to marry a rich person)", and the second can be paraphrased "that she's rich is not the reason I married her (it's because I love her)". This contrast falls out nicely from the analysis we have developed so far for these two contours. The IS partitions and instructions for both sentences are given below, respectively:[28]

(126) [Fr I didn't marry her because she's [Co RICH]]
                                          H* L-L%

    a. iCore: *rich´*

    b. iFrame: the properties she has such that I didn't marry her because of them

    c. LINK: retrieve the iFrame

    d. EDIT: assert that *rich´* is one such property

(127) [Fr I didn't marry her because she's [Co RICH]]
                                          H* L-H%

    a. iCore: *rich´*

    b. iFrame: the properties she has such that I didn't marry her because of them

    c. LINK: retrieve the proposition that there is no property such that I didn't marry her because of it (= for all properties, I married her because she has that property)

    d. EDIT: contradict the LINK proposition by asserting that *rich´* is a property such that it's not the case that married her because of it.

---

[28] I will avoid the intricacies of capturing the denotative meaning of *because* in a rigorous and transparent logical notation by merely paraphrasing the denotation of the iFrame.

There is a bit of sleight-of-hand in this analysis that warrants discussion. Essentially, the denotation of the iFrame and even the value of the EDIT are ambiguous between the two readings. I assume this is the case because the sentential negation can either apply to either to the first clause (i.e., "it's not the case that I married her (because she's rich)"), or to the entire sentence (i.e., "it's not the case that (I married her because she's rich)") because of its position in the higher clause. If the clause order is reversed, that ambiguity is destroyed (and the L-H% intonation does not have the same effect):

(128)   Because she's rich I didn't marry her.

(129)   It's not because she's rich that I married her.

However, since the iFrame and the EDIT instructions for (126) and (127) are ambiguous, the LINK serves to disambiguate them, at least for (127), because of the effect of the L-H% contour. That is, because the L-H% contour introduces a ¬∃ into the LINK, which interacts with the negation such that ¬∃¬ ↔ ∀, the LINK essentially asks the listener to retrieve the proposition that for all (relevant) properties, I married her because of those properties. The ¬∃ must interact with the sentential negation in this way, because they both take scope over both clauses. Note that if the sentential negation is forced to take scope over only the initial clause, by introducing a prosodic break between the clauses, the L-H% contour does not induce the same reading.

(130)   ? I didn't MARRY her,   because she's RICH
                    H*   H-L%   H* L-H%

Therefore, since the sentential negation must interact with the ¬∃ introduced by the

L-H% contour in (127), it induces a LINK to a proposition equivalent to "all of her

qualities are reasons that I married her." Since the assertion made by EDIT is

ambiguous, it is taken to be the reading that does not conflict in background

presuppositions with the LINK. That is, the EDIT assertion could mean "the reason I

didn't marry her is that she's rich", but that would be a pragmatically strange way to

reply to the LINK assertion that "every reason is a reason I married her", because it is

denying the presupposition that I married her. Since the EDIT assertion can also mean

"that she's rich is not the reason I married her", which is a perfectly appropriate way to

contradict the LINK assertion, this reading is accepted over the other, effectively

disambiguating the EDIT.

        This predicts that in contrast with (127), (126) should be ambiguous, because like

(127), both the Frame and EDIT are ambiguous, and unlike (127), the LINK does not

help to disambiguate, the overall reading of (126) should remain ambiguous. This is in

fact what happens, though there appears to be a bias towards the reading of "the reason I

didn't marry her is that she's rich." It is not hard to think of discourses in which it could

have the other reading.

(131) A: You married her just to get your hands on her millions of dollars.

       B: Look, you're dead wrong. I didn't marry her because she's RICH
                                                  H* L-L%.

It is not entirely clear exactly why there is a bias towards the "I didn't marry her"

reading, but it may have something to do with a preference for the negation to not take

wide scope over the entire sentence, but rather only the initial clause.

       In any case, the basic contrast between the readings, and the presence of

ambiguity for (126) and the lack of it for (127) are all predicted nicely by mechanisms we

have motivated for independent reasons, adding to the empirical coverage of the present

theory.

2.12   Conclusions

In this chapter, I have motivated a novel theory of Information Structure centered around

the Partition-Instruction Independence (PII) Hypothesis. This hypothesis claims that a

sufficient model of IS can be constructed with two simple and independent classes of

primitives: partitions and instructions.

       The partitions called the Informational Frame (iFrame) and Informational Core

(iCore) (roughly analogous to Topic-Focus, background-focus, theme-rheme, old-new,

etc.) are used to divide the propositional content of a sentence into distinct "chunks",

where the iCore is a simple denotation and the iFrame is an abstraction whereby it returns

a value of "true" if the iCore is substituted for the variable in the iFrame. In this way, the

partitions provide the denotative "material" for the informational instructions.

The instructions posited in this theory are LINK and EDIT, which provide the basic operations to relate the denotational content of the partitions to the discourse. The LINK instruction is phrased as a request to the listener to retrieve some propositional content (proposition, property, individual, etc.) as the discourse context for the speaker's utterance. The EDIT instruction makes a suggestion to the listener as to how to update their knowledge representation, often by modifying the conceptual "entry" retrieved by the LINK.

This system of partitions and instructions can be metaphorically described as a shipping system. The partitions provide the raw packages and the content of those packages. The instructions are like the shipping company, where LINK is like fixing on an address for delivery, and EDIT is how the delivery is made. Ultimately, what information is taken away depends on the recipient, but the manner in which it is packaged and delivered makes a significant difference in the course and function of the discourse.

I have shown how this system handles a wide variety of data, including basic "focus" structures that form the empirical foundation of any theory of IS, as well as the meaning and function of specific intonational contours, especially the L-H% contour. The analysis of the L-H% contour presented here appears to have many advantages, including a unified account of the "contradiction" and "echo question" contours. But the main goal is to provide an analysis of apparent truth-conditional effects of IS, and I have done so in several different important data sets, including so-called "inverse scope"

effects, *only*, counterfactuals, and *because*-clauses. The issue of indefinites was raised, but postponed for the next chapter.

Among the many remaining issues is the matter of other intonational contours. I have thus far only discussed the L-L% and L-H% contours. Given the typology of Pierrehumbert (1980) and following work, this leaves at least two more contours to address (H-L% and H-H%), and there is of course a possibility that more contours or intonational contrasts exist. Unfortunately, this will have to remain a limitation of the present work and left to future research. But given the tools developed in this chapter, we have a clear hypothesis about how to proceed with such analyses. I expect that if these contours represent additional informational distinctions, they can be captured as additional modifications to the LINK and/or EDIT instructions. In particular, it would be interesting to see whether some kind of compositional meaning can be ascribed to the tones, as Steedman (2000) and Pierrehumbert & Hirschberg (1990) attempt to show, or whether these contours are best treated as single units.

Thus concludes the first substantial section of my attempt to reconcile truth-conditional effects of IS with the T-model architecture of grammar. The theory developed so far appears up to the task of providing a clear interface between IS and LF, such that IS is dependent on LF, but not *vice versa*. The next task is to demonstrate how a theory of the IS-syntax relationship that maintains Minimalist principles and the T-model architecture can give rise to the IS argued for in this chapter. This is the topic of the next chapter.

CHAPTER 3

INFORMATION AND STRUCTURE

3.1   Introduction and overview

The overarching aim of this dissertation is to develop a theory of Information Structure

(IS) with two primary goals, one empirical and one theoretical. The empirical goal is to

provide an analysis for data in which prosodic structure appears to affect truth conditions.

The theoretical goal is to see whether this analysis is able to maintain the grammatical

architecture of the Principles & Parameters and Minimalist traditions, whereby

phonological information (PF) and logical information (LF) are strictly segregated.

In the previous chapter, I argue for the novel Partition-Instruction Independence

(PII) hypothesis. In this model, IS is composed of two elements: partitions and

instructions. The partitions provide the system with the basic units of information, and

the instructions provide the content of how those units are used to present information.

This general idea is not entirely novel, and follows Vallduví (1992) and Steedman

(2000a, 2000b) in general spirit. The novel aspect of the PII hypothesis is that the

partitions and instructions are independent, whereas in previous theories, the definition of

IS categories (old, new, topic, focus, theme, rheme, comment, presupposition, etc.) has

always confounded the two, by strictly committing certain units to certain functions. PII

argues that a simpler and more successful system is one in which units and functions are

allowed to interact, but vary independently from each other.

The analyses presented in Chapter 2 depend on a particular scheme for representing the partitions and instructions. The instructions are provided entirely by lexical items, including intonational boundary tones as lexical items (somewhat following Steedman (2000a, 2000b) in this respect). The partitions, however, are given as structural bracketing of a sentence's constituents. This formalism raises two crucial questions, which I aim to address in this chapter. First, how are these partitions made available to IS? Second, does the method of creating these IS partitions violate the Minimalist architecture of grammar?

The chapter proceeds as follows. In section 3.2, I start with a critical review of previous theories of IS representation, and argue that the traditional methods of F-marking and covert movement to functional projections are irreconcilable with the Minimalist architecture. Section 3.3 presents a conceptual argument that the current theoretical notion of "phase" is precisely the kind of mechanism that could provide IS partitions without violating the PF-LF split. That section includes a short review of the theory of phases as proposed by Chomsky (2000, 2001). Section 3.4 refines the proposal through a demonstration of how this re-formulation of phases is able to produce the Informational Core (iCore) and Informational Frame (iFrame) partitions needed to capture the data in Chapter 2. Section 3.5 discusses some of the broader syntactic consequences of the proposal, which motivates additional refinements in order to preserve some of the functions that phases are more traditionally conceived to provide. Section 3.6 concludes.

3.2   Previous representations of IS

Since Jackendoff (1972), the dominant method of representing IS is with abstract features. Jackendoff (1972) used the feature F to represent Focus (roughly corresponding to the iCore in the present theory), and since he was only interested in Focus phenomena, this was the only labeling scheme he needed. In this system, F is simply a marking applied to constituents or nodes in the syntactic tree.

This basic mechanism is extremely pervasive throughout the literature, though there is a fair amount of variety in how F-marking is applied, and exactly what it means (cf. Jackendoff 1972; Selkirk 1984, 1995; Rooth 1985, 1992; Büring 1997, 2005; Zubizarreta 1998; Erteschik-Shir 2006). For example, some researchers only use F to notate contrastive focus (however they might define that) or other kinds of operator Focus (O-Focus), while others use it to mark informational Focus (I-Focus) as well.[29] Some (e.g., Jackendoff, 1972; Selkirk 1984, 1995; Rooth 1985, 1992) only have use for a single feature [F], while others have argued for more complex systems of features (e.g., Büring 1997; Zubizarreta 1998; Erteschik-Shir 2006).

The use of this formalism has persisted for essentially two reasons. First, it is an extremely simple way to formalize IS. However, simplicity is not always a virtue, when it leads to inaccuracy or missed generalizations, and the convenience of F-marking may in fact not translate to theoretical simplicity.

The second reason F-marking has persisted is related to the architectural questions that this dissertation is concerned with. Namely, by marking IS as a feature in the syntax,

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[29] See section 2.3 for the distinction between O-Focus and I-Focus.

the F feature is able to have both phonological and interpretational effects. In the typical

T-model of grammar, syntax precedes phonology and semantics,[30] and so a feature

marked in the syntax can "trickle down" to affect both sound and meaning. See Figure 3-

1 for an illustration.

Figure 3-1: Trickle-down effect of F-marking
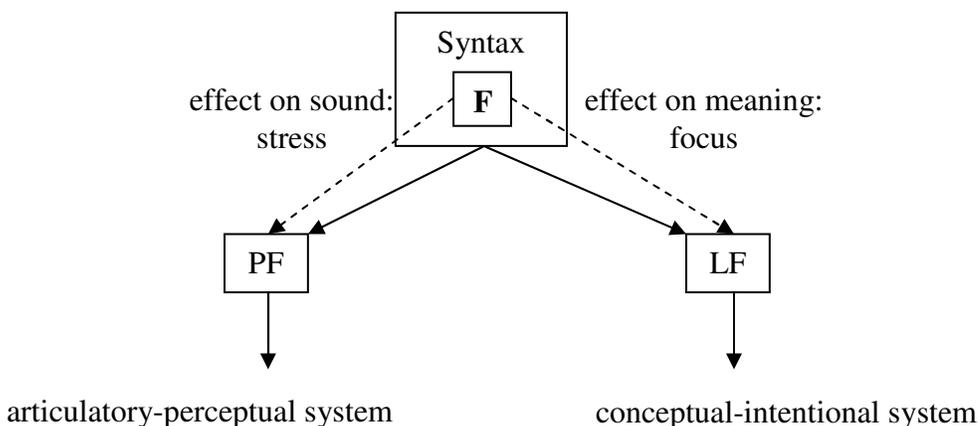
This trickle-down effect is convenient, because of the overwhelming cross-linguistic

generalization that Focus (both O-Focus and I-Focus) is connected with sentential stress.

Putting a feature like F in the syntax allows for an easy way to use the feature to affect

both stress assignment on the PF side and information structure on the LF side.

However, this convenience comes at a price. This use of F-marking is essentially

a deceptive short-hand for a direct connection between PF and LF, which is a violation of

the T-model. I will present this argument first in general terms, and then in the more

specific language of the Minimalist program. The general argument is that in the

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[30] By "precede," I of course mean in the derivation, not some kind of temporal precedence or other notion of primacy.

majority of cases, F has no real place in the syntax, and it is introduced into the syntax only for the "trickle down" benefit. This can be illustrated by a hypothetical example. Imagine we propose a feature M, which marks the domain of NPI licensing and reflects this as nasalization. If a node is M-marked, NPIs are licensed under that node, and all the stop consonants associated with words under that node become [+nasal]. This may sound like a ridiculous feature, but this is exactly parallel to the use of F to simultaneously mark stress and information domains. The question here is not only theoretical, but empirical. That is, even if we accept this as a denial of the Minimalist architecture, the remaining question is why there do not appear to be many such features. That is, if we allow F-marking to operate this way, why does there appear to be no other similar feature, such as the hypothetical M? The simplest answer, of course, is simply that F-marking, while convenient as a shorthand of sorts, is ultimately wrong, and that there must be some other mechanism for marking IS in natural language.

However, more needs to be said about the off-handed claim above that F has "no real place" in the syntax. Coming from an English perspective, this is not particularly controversial, as IS can behave rather independently from word order. However, someone coming from a more cross-linguistic perspective may not be so quick to accept this. Research on Romance languages (e.g., Vallduví 1992; Zubizarreta 1998), German (e.g. Krifka 1998; Zubizarreta 1998), and Finno-Ugric languages (e.g., Vallduví & Vilkuna 1998; É. Kiss 1998), just to name a few, has suggested that word order and information structure can be very closely linked indeed. Comprehensive review of this research is beyond the scope of this dissertation, but I will raise two points that cast doubt

on the necessity of F-marking in syntax, even in these languages where word order and F appear to interact closely.

First, even though these languages use word order to reflect IS configurations, stress and intonation are still part and parcel of representing IS. I argue that these languages are merely the mirror image of English. While English has relatively rigid word order and relatively flexible sentential stress assignment, languages like Spanish, Catalan, and Hungarian have relatively flexible word order and relatively rigid stress placement. For example, Hungarian allows fairly "free" constituent ordering in the postverbal domain, and it allows lots of movement to pre-verbal operator positions. However, primary stress always falls on the initial word of the sentence (excluding the Topic position). Other constituents can also receive stress, but the initial (post-Topic) word must *always* receive primary stress (É. Kiss, 1987). The argument is that in languages where IS is claimed to be reflected in the syntax, not in the phonology, in reality, the relatively flexible syntax is adjusting word order to ensure that IS lines up with canonical stress patterns.

The second argument is somewhat more oblique, but still worth mentioning. There may be a subtle but important differences between the *syntactic* encoding of IS through word order, and the *conventional* encoding of IS through word order. For example, the English passive is often used as a way to change the IS of a sentence. That is, typically a sentence like (1) is "about" Schatzi and emphasizes what she ate, and a sentence like (2) is "about" cheese and emphasizes who ate it.

(1)   Schatzi ate the CHEESE.

(2)   The cheese was eaten by SCHATZI.

However, it does not appear that passive actually "encodes" this difference in IS in any strict sense. What it does is exactly what I claim above that more "free word order" languages do. It is allowing a canonical sentence-final stress pattern to remain, while shuffling the constituents around to make a different one end up with stress, which is indicative of its informational status. This becomes clearer when we mark the various options for IS:

(3)   [Fr Schatzi ate [Co the CHEESE.]]

(4)   [Fr [Co SCHATZI] ate the cheese.]

(5)   [Fr The cheese was eaten by [Co SCHATZI.]]

(6)   [Fr [Co The CHEESE] was eaten by Schatzi.]

Sentences (3) and (5) represent the canonical patterns, where primary stress and the iCore are both sentence final, while sentences (4) and (6) represent non-canonical patterns, where stress and the Core are both sentence initial. Note that while above I emphasized the issue of a canonical stress pattern, the issue of a canonical IS pattern may be just as relevant. After all, when Halliday (1967) made the claim that all sentence-initial constituents were Topics in English, which turns out to be false, it was not so outlandish as to be immediately dismissible, precisely because the canonical position for Topics

(i.e., the part of the iFrame outside the iCore) in English is at the beginning of the sentence.

Returning to the discussion of passive, if the speaker wishes to express the proposition that Schatzi ate the cheese while emphasizing the fact that it was Schatzi that was involved, she has two options. She can use non-canonical (i.e., passive) word order with canonical sentence stress and Core positioning, or she can use canonical (i.e., active) word order with non-canonical sentence stress and Core positioning. This independence of options clearly demonstrates that the idea that passive "encodes" IS is an illusion.

Why then, is this illusion perceived? It depends entirely on the significance of canonical patterns. It is well-known that although individual languages typically allow for great variety of structural configurations, they also typically use certain structural options far more frequently than other options, which has been shown to have significant effects on speaker expectations and online processing (Townsend & Bever, 2001). As noted above, passive structures in English are able to preserve canonical patterns of stress and IS when the grammatical subject is the informational iCore. Therefore, by mere association, the passive structure conventionally (though not categorically) represents a shift in IS. On this basis, I argue that word order effects of IS in other languages follow the example of the English passive, and it is thus more accurate to claim that in these languages, canonical stress/IS patterns are more salient than canonical word order patterns simply by convention, not because some IS feature F is active as a syntactic feature. Taken together, these points argue that something like F-marking in the syntax is not necessary or desirable to explain word order effects that affect IS. I claim instead that

in these cases, syntactic options (such as passive, or scrambling) are exploited in order to ensure that stress (which must occur on the iCore) lines up with a canonical stress position.

To summarize the argument so far, the formalism of F-marking is essentially a shorthand for a direct connection between PF and LF, because 1) it is an arbitrary feature with specific effects at both PF and LF, and 2) because it is doubtful that it plays any role as an actual syntactic feature, reducing its existence in the syntax to a suspicious convenience rather than one of syntactic necessity. In terms of Minimalism, this argument can be recapitulated as noting that F-marking is in clear violation of the Inclusiveness principle.

According to Chomsky (1995), Inclusiveness is a fundamental principle of the grammar, which forbids any syntactic features that are not part of lexical items. That is, the only mechanism that can introduce features into the derivation is the Numeration operation that does a one-time selection of an array of lexical items from the lexicon. This is an explicit ban on "diacritic features", and F-marking clearly qualifies as a diacritic feature. Inclusiveness is not simply an arbitrary restriction on the power of the grammar; it is the very principle that prevents arbitrary features like the hypothetical M discussed above, which are basically backdoors to allowing a direct PF-LF connection. In other words, a violation of Inclusiveness is tantamount to allowing PF to access LF in order to assign stress, and/or allowing LF to access PF in order to know where IS categories are.

Of course, I am not the first to notice this problem. There have been essentially four responses to this dilemma, none of them satisfactory. First, some researchers, like Büring (1997, 2005) and Irurtzun (2006), merely ignore the issue altogether, and continue using F-marking, essentially as it was done by Jackendoff (1972). Zubizarreta (1998) revises the T-model architecture significantly in order to try to justify the violation of Inclusiveness, which simply substitutes one way of violating the PF-LF divide for another. Erteschik-Shir (2006) also points out the Inclusiveness problem, but her solution is to simply make IS features (she uses [+topic] and [+focus]) lexical features by *fiat*. If we take this proposal seriously, we must admit that the lexicon has tripled in size, to allow for (e.g.) *dog* [+topic], *dog* [+focus], and *dog* [unmarked], which is clearly a less than ideal solution. Finally, perhaps the majority position, exemplified by Szendrői (2004), is that perhaps a violation of Inclusiveness is simply not that bad. After all, Chomsky (1995) himself admits that it is almost certainly violated on the PF side, because presumably intonational features cannot enter the derivation until Spell-Out or later.

This last point about resigning to a violation of Inclusiveness deserves a bit more discussion. First of all, it is of course legitimate to believe that IS phenomena constitute a case against the T-model (cf. Hunyadi 2002). However, it is the goal of this dissertation to test this by attempting to find a theory that preserves the T-model, so this is not an acceptable solution for the present. Second, Chomsky's (1995) admission that Inclusiveness is violated by PF is very different from admitting that it is violated in the syntax. If non-lexical phonological features (i.e., prosodic features) are introduced into

the grammar after Spell-Out, this does not constitute a violation of the T-model, because there is no way for LF to be affected by those features. This of course changes if one's theory locates stress and intonation assignment *before* Spell-Out (Selkirk 1984; Zubizarreta 1998). If prosodic features (like F) can be introduced before Spell-Out, and thus also appear at LF, then this is not a trivial violation of Inclusiveness, as Chomsky (1995) suggests for "pure" intonational features.

Finally, another facet of the "so what?" viewpoint is that IS is somehow an exceptional system, and that by allowing IS to violate Inclusiveness, one does not necessarily have to give up Inclusiveness altogether. However, these conclusions are hardly warranted. For one, IS is a central facet of language, and brushing it off as "peripheral" is a common but lamentable mistake. A less ideologically-bound problem is that it is unclear how exactly to make the distinction between IS features, which are allowed to "cheat" Inclusiveness, and other "proper" syntactic features that are not allowed to cheat. Without principled criteria of what counts as acceptably exceptional, this move is simply sweeping the issue under a rug, because it is more pleasant to ignore than address directly.

Thus I conclude my argument against F-marking in general. Any mechanism that allows the introduction of formal IS features into the syntax is in clear violation of Inclusiveness, and therefore of the T-model in general. It is for this reason that the theory developed later in this chapter attempts to dispense with F-marking entirely as a means of representing IS.

There is another class of theories of IS representation, in which the partitioning of IS categories is achieved through movement to functional categories. Chomsky (1976) was the first to propose an analysis along these lines. Although he does not frame it as movement *per se*, Chomsky (1976) proposes a rule FOCUS that created a variable-operator structure exactly parallel to his proposal for QR operations in which quantifiers create the same kinds of variables. For example, Chomsky (1976) proposes that (7) and (8) (his (115) and (116)) have the LF structures in (9) and (10) (his (117) and (118)), respectively:

(7)   Bill likes JOHN.

(8)   BILL likes John.

(9)   the x such that Bill likes x – is John

(10)   the x such that x likes John – is Bill

This analysis is motivated in order to explain the following data:

(11)   The woman he$_i$ loved BETRAYED John$_i$

(12)   *The woman he$_i$ loved betrayed JOHN$_i$

Sentence (12) is marked ungrammatical because of the impossible coreference between *he* and *John*. Chomsky (1976) also proposes a binding restriction that states "a variable cannot be the antecedent of a pronoun to its left. (p. 342)" This rule, along with the

FOCUS proposal, serves to rule out (12) but not (11). In more modern terms, the analysis is essentially suggesting that the FOCUS element undergo QR to some functional category, which can then affect binding relations. Putting aside the binding issue, there appears to be an independent explanation for this data, which appeals directly to the actual function of the IS in these examples, without recourse to covert raising analyses.

The first part of the puzzle is that the pronoun in (11) is not locally bound by its antecedent (Binding Principle B). However, in order to get reference, it needs to be *discourse* bound. That is, there needs to be a referent in the discourse for *he* to be interpreted. In (11), the Core is *betrayed*, and so *John* is in the Frame. Because every element in the Frame is assumed (by the speaker) to be already present in the discourse, the effect is to facilitate the reading that *John* and *he* corefer, by making *John* the discourse antecedent of *he*, even though the discourse itself is "virtual", in the sense of not actually existing in this example, but rather projected backwards from the IS of the sentence. This idea of "backwards projection" of a discourse is not as strange as it might sound. Any apparently out-of-the-blue sentence that contains a definite noun has the same effect.

(13)   [$_{Fr}$ The woman he$_i$ loved [$_{Co}$ BETRAYED] the sailor$_i$]

Conversely, when *John* is in the iCore, as in (12), the effect is the opposite, where *John* is presumed either not to be in the discourse yet, or else he is being compared against an

alternative set, which *is* in the discourse. This becomes clearer when we imagine

possible discourse backgrounds for these sentences, as in the following.

(14) A: Did you hear what happened to John?

B: I heard that some woman totally backstabbed him.

A: That was his wife!

B: Really?

A: Yep, [$_{Fr}$ the woman he$_i$ loved [$_{Co}$ BETRAYED] John$_i$]

(15) A: Did you hear that John's wife, who he is completely devoted to, totally

backstabbed him?

B: No, you're mistaken. It was her sister, who screwed over her boyfriend Bill.

A: No, it's true, *[$_{Fr}$ the woman he$_i$ loved betrayed [$_{Co}$ JOHN$_i$]]

(16) A: Did you hear about John's wife backstabbing him?

B: No, I heard that she screwed over Bill, not John.

A: No, it's true, [$_{Fr}$ the woman he$_i$ loved betrayed [$_{Co}$ JOHN$_i$]]

These data show two things. First, in (15), where the coreference is bad, it appears to be

at least in part because *Bill* is a more recent discourse referent than *John*, which makes

him a much better candidate for coreferring with *he* than *John* is. I claim essentially that

this is the kind of "virtual" discourse background that is normally constructed from an

out-of-the-blue version of (12). Second, note that the presumably ungrammatical (12)

becomes much improved when embedded in a discourse that supports the coreference

rather than opposes it. One might object that this is artificially "helping" (12), but my response is that if Chomsky's (1976) proposed binding restriction is indeed in the grammar, then discourse support should not be able to improve it significantly. Therefore, it appears that there is an alternate solution that obviates the need for any explicit FOCUS raising analysis.

As a side note, it is interesting that the bound variable structures that Chomsky (1976) proposes as the result of the FOCUS rule are so strikingly similar to the semantic values of the iCore and iFrame as proposed in Chapter 2. I assume that this is not a coincidence, and that the structures in Chapter 2 are on the right track, even though they are derived without a need for actual movement.

Chomsky (1976) is not the only theory that proposes movement to functional heads as a representation of IS. Probably the most well-known proposal is Rizzi (1997), who argues for a highly articulated cascade of functional heads between CP and TP/IP. I will not review all the details here, because this account and virtually any other movement-based account inherit all the problems of F-marking theories. The reason for this is that in Minimalist syntax (Chomsky, 1995), movement is only licensed when it is forced by feature-checking. For example, *wh*-words have a morphological feature that is uninterpretable at the LF interface, forcing *wh*-words to move to an appropriate landing site in [Spec, CP], in order to have the feature checked and rendered inert. So in essence, by claiming that IS categories like Topic and Focus universally move to higher functional heads, Rizzi (1997) and others must claim that these constituents have some feature that drives the movement. Such a feature cannot be lexical (for the same reason that

Erteschik-Shir's (2006) proposal requiring all words to have three different versions in the lexicon is problematic), and so must ultimately result in the same kind of Inclusiveness violation as standard F-marking theories. In other words, there is a problem with F-marking, and movement theories must assume some kind of F-mark in order to drive the movement, so they inherit the same problems.

This criticism of Rizzi-style raising analyses does not hold if a different kind of feature checking is used.[31] That is, instead of movement being driven by features on the thing that moves, it may be driven by a need to check or "value" unchecked/unvalued features on a functional head. Under this kind of theory, a [+F] feature for focus may exist as part of a Focus functional head. In this case, it would make sense for such a feature to be introduced by the lexicon, and therefore satisfy Inclusiveness. The functional head could drive movement into the specifier of Focus without a need for diacritic features on the focused elements themselves.

While this kind of theory solves the Inclusiveness problem it raises a different set of problems. Namely, it raises the question how stress gets assigned to the Focused elements. In a language like English, where overt Focus movement is not obligatory (i.e., it is possible, and indeed most common for focused elements to remain *in situ*), it is not clear how focus stress gets assigned in the absence of a [+F] feature on the focused constituent. If the feature is only on the functional Focus head, and movement to the [Spec, Focus] position happens covertly (after Spell Out, see section 3.3), then the phonological component cannot have any knowledge of which elements are in focus –

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[31] Thanks to Andrew Carnie for raising this point.

and thus cannot correctly assign focal stress – without some kind of look-ahead function that allows the phonological component to know what will happen later in the syntax. This kind of look-ahead function is at least as bad as a violation of Inclusiveness in terms of keeping the PF-LF divide meaningful.

A possible solution for this problem would be the idea that the focused elements *always* move overtly (and are thus always visible to the phonology), and that the rest of the sentence moves up, too, to something like Rizzi's (1997) Topic position. Rizzi claims that above the tense/inflectional head, there is a single Focus head, surrounded by (optional) iterative Topic heads. This structure is shown in 0.

(17)

```
                CP
            ╱        ╲
        Spec          C'
                   ╱      ╲
                  C        TopicP*
                         ╱        ╲
                      Spec         Topic'
                                ╱        ╲
                            Topic         FocusP
                                       ╱        ╲
                                   Focus          Focus'
                                              ╱        ╲
                                          Focus          TopicP*
                                                            ┊
                                                            TP
                                                           ╱╲
                                                          ╱──╲
```
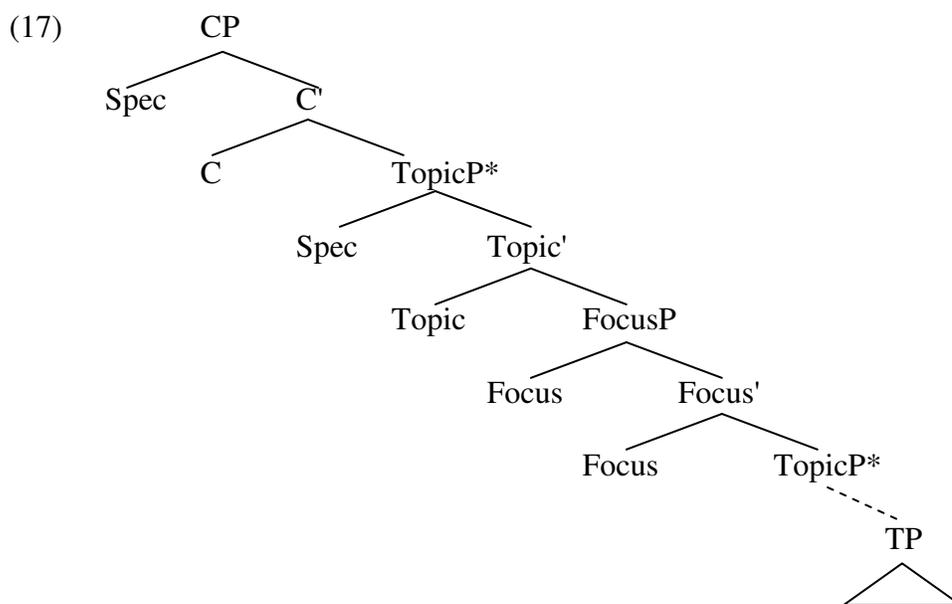
This is exactly the kind of structure needed for the kind of wholesale movement of everything out of the TP in order to prevent the need for phonological look-ahead. So a

sentence with the IS as argued for in Chapter 2 like (18) would have a syntactic structure

as in (19).

(18)   [$_{Fr}$ Schatzi [$_{Co}$ LIKES] cheese]

(19)   [$_{CP}$ [$_{TopP}$ Schatzi [$_{Foc}$ LIKES [$_{TopP}$ cheese [$_{TP}$ t t t]]]]]

This may or may not be problematic, depending on what the theory is regarding how the

interpretation of Topic and Focus phrases works. Rizzi (1997) claims that the specifiers

and complements of Topic and Focus are to be interpreted as shown in (20).

(20)

TopicP
"topic"   Topic'
        Topic   "comment"

FocusP
"focus"   Focus'
        Focus   "presupposition"
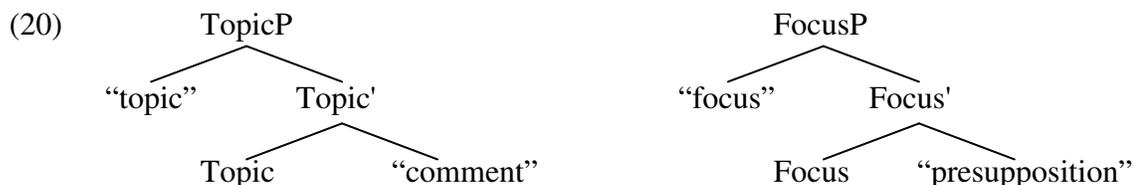
In a structure like (19), this scheme has the effect of claiming that *likes* is the focus, but

only *cheese* is in the presupposition, to the exclusion of *Schatzi*, which is unexpected.

Furthermore, it claims that *cheese* is part of the "comment", which is also controversial.

As another example, consider the sentences (with IS's marked) and their Rizzi-style

syntactic structures in (21)-(24).[32]

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[32] In (24), I am assuming the simplest option of moving the entire VP to a single [Spec, Topic], though it is
unclear whether this is an option for Rizzi (1997). Assuming a more complex nested TopicP structure
would only add to the arguments in the text.

(21) [$_{Fr}$ Schatzi likes [$_{Co}$ CHEESE]]

(22) [$_{CP}$ [$_{TopP}$ Schatzi [$_{TopP}$ likes [$_{FocP}$ CHEESE [$_{TP}$ t t t]]]]]

(23) [$_{Fr}$ [$_{Co}$ SCHATZI] likes cheese]

(24) [$_{CP}$ [$_{FocP}$ SCHATZI [$_{TopP}$ likes cheese [$_{TP}$ t t t]]]]

If we are to interpret Rizzi's (1997) proposal strictly, then *Schatzi likes* is not a "presupposition" in (21)-(22), but *likes cheese* in (23)-(24) is, since the former is not a complement to Focus, but the latter is. There seems to be no evidence for this implicit claim at all, given that both seem to be equally presupposed in their respective sentences. Additionally, it is also unclear that *likes cheese* is a "comment" on *Schatzi* at the same time as *cheese* is a "comment" on *likes*.

In fairness to the general syntactic approach, it may be that Rizzi's interpretational scheme as given in (20) is simply overstated, and that it is really just the specifiers that get interpretations, not the complements. If this line were taken, then the story improves considerably.

However, the Rizzi (1997) account encounters problems with examples of multiple foci. Rizzi explicitly claims that multiple foci are impossible, but he only uses Italian left dislocation data such as (25) to argue for this. The English examples in (26) and (27) make a case that multiple foci are quite possible.

(25) * A GIANNI IL LIBRO darò (non a Piero, l'articulo)[33]
      "TO JOHN THE BOOK I'll give, not to Piero, the article"

(26) Q: Who ate what?
      A: [$_{Fr}$ [$_{Co}$ SCHATZI] ate [$_{Co}$ CHEESE]], [$_{Fr}$ [$_{Co}$ CORA] ate [$_{Co}$ BROCCOLI]]…

(27) A: [$_{Fr}$ [$_{Co}$ Petr only gave xerox copies to the [$_{Co}$ GRADUATE] students]
      B: No, [$_{Fr}$ [$_{Co}$ EVA] only gave xerox copies to the [$_{Co}$ graduate] students]

Example (26) uses a common pair-list question structure, where both items in the pair

would clearly need to be in [Spec, Focus] in Rizzi's system, though following the

argument so far, they would need to be in different Focus phrases, with an intervening

Topic phrase, which is not allowed in Rizzi (1997). (27) is a case of so-called "second-

occurrence focus" from Partee (1991), where it is argued that despite the lack of a strong

phonological stress on *graduate* in the second sentence, it must clearly be in focus,

because it can only get the reading where *only* is associated with *graduate*. So for

theories that require *only* to associate with information structure such as focus (including

my theory, as well as standard accounts such as Rooth 1985, 1992), it is necessary that

(27) be analyzed as having two distinct foci.

The admission of multiple foci to the theory of Rizzi (1997) may not be lethal, but

it does significantly weaken the claim that the Italian data is an overt reflection of what

happens more covertly with other language such as English. It may be possible to rescue

the theory from this problem if some argument can be made that the restriction on

multiple foci in Italian is due to phonological reasons rather than syntactic or semantic

ones. I will not pursue such an analysis here, but merely end the inquisition of Rizzi

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[33] From Rizzi (1997), ex. (22).

(1997) by noting that in order for that theory to accommodate the range of English data without violating Minimalist principles, some significant concessions need to be made. However, further data regarding indefinites and the Mapping Hypothesis in section 3.5 will give additional evidence for the alternative phase-based theory I propose below. This data proves more difficult for a Rizzi-style analysis, because it depends on the notion that focus can create reconstruction effects, which is unexpected in a theory of IS that only requires topic and focus to *raise* to functional categories.

Before leaving discussion of movement theories entirely, I should discuss the case of Hungarian Focus. Following Horvath (1986) and É. Kiss (1987, 1998), the standard analysis of Hungarian is that there are several preverbal positions that are landing sites for operators of various kinds. The immediately preverbal position is referred to as the Focus position. However, this does not constitute a strong argument for IS-related movement. É. Kiss (1998) argues that there are two distinct types of focus, what she calls "informational focus" vs. "identificational focus." I follow Horvath (2000) in assuming that the use of the term "focus" for identificational focus is mistaken, because the functional head driving the movement is not informational in nature, but quantificational in nature, in the sense of binding a variable and interacting with other scope-bearing elements like quantifiers. An example from Chapter 2 is repeated here:

(28)   a.   [_FP_ JÁNOS   [_VP_ köszöntött   mindenki-t.]]
                          János   greet.PAST   everyone-ACC
                    'It was János who greeted everyone (no one else greeted everyone).'
                    Focus > ¬

        b.   [_DistP_ MINDENKI-T   [_FP_ János   [_VP_ köszöntött.]]]
                      everyone-ACC   János   greet.PAST.
                    'For every person, it was János (no one else) who greeted them.'
                    ¬ > Focus

In (28a), the Focus on *János* takes wide scope over the universal quantifier *mindenkit* 'everyone-ACC', and vice versa in (28b), leading to different truth conditions. However, it is not some strictly informational notion taking scope. Rather, it is an exhaustiveness operator. Horvath (2000) argues that the functional head in this position is precisely an operator of exhaustive identification, and has little or nothing to do with an informational category like Focus. Therefore, this convincing case of true movement turns out not to be IS movement at all, but rather a QR-type movement to an exhaustiveness operator. This casts doubt on the idea that Focus must be universally treated as movement.

      In summary, in this section I have argued against the two most standard ways of representing IS in the syntax. So-called F-marking features use diacritic features to label nodes as Focused (or other IS categories), which then gets translated as stress at PF and as an informational category at LF. This practice is essentially a direct PF-LF connection, with a little sleight-of-hand to obscure the connection slightly. The standard ways of dealing with this problem, from simply ignoring it to tripling the lexicon by *fiat*, appear unsatisfactory. Movement theories of IS have their own issues, but ultimately inherit the same problems as F-marking theories, and so also appear unsatisfactory.

Ultimately, a proposal along one of these lines may turn out to be correct, but admitting that would be a rejection of the T-model, so until we have such evidence, I argue that we should look elsewhere for a theory of how to represent IS in the syntax.

3.3   A phase-based proposal

The discussion so far has left us with a dilemma. On the one hand, we need a representation that will accurately capture the relationship between the PF manifestation of IS partitions (i.e., stress assignment[34]) and the LF/IS effects of those partition. This suggests that the locus of representation should be the syntax, since syntax is the sole mediator between PF and LF. One the other hand, previous theories that placed IS into the syntax via the mechanisms of F-marking or movement to functional projections constitute clear violations of the PF-LF divide, obviating the need for a mediator at all. How are we to reconcile these two observations, that we might discover a syntax-grounded representation that nevertheless preserves the T-model?

A possible solution presents itself via the mechanism of the derivational *phase*, as proposed by Chomsky (2000, 2001).[35] This mechanism and the underlying theory will be presented in detail in the next section, but in short, it represents a link between the cyclic application of syntactic and phonological rules. It packages sub-units of a derivational tree to be "sent off" to both phonological and semantic interpretation interfaces before the

---

[34] Recall that intonational contours with IS effects are assumed by this theory to be represented as proper lexical items. This choice takes this element of IS out of the current discussion, because as lexical items, they do not threaten Inclusiveness at all. The main issue here is deriving the connection between focal stress and the IS partitions of iCore and iFrame.

[35] There are other prominent theories of multiple Spell-Out, such as Uriagereka (1999), but the theory here relates much more closely to that of Chomsky (2000, 2001) and following work.

entire sentence is derived. Each package, or phase, represents a miniature domain of rule application at both interfaces.

The appeal of co-opting this mechanism for IS should be apparent. In Chapter 2, I argue for a theory of IS in which a system of tree-partitioning provides the primitive units of IS. Phases appear to be able to provide such partitions, at least hypothetically. Furthermore, because phases are not (at least in my theory) driven by diacritic features such as F-marking, or functional heads such as Focus, they ostensibly provide a "legal" (i.e., well-constrained) means of mediating PF and LF.

In the rest of this chapter, I argue that in fact, phases can be effectively employed to provide the basic IS partitions of iCore and iFrame as described in Chapter 2. I furthermore argue that this modification of phase theory does not detriment previous work in the theory, and may even offer some improvements. This argument proceeds as follows. In section 3.3.1, I review the theoretical and empirical basis of phase theory, following Chomsky (2000, 2001). In section 3.3.2, I propose the Phase-Information Correspondence Hypothesis (PICH) as a modification to phase theory, which will allow phases to manufacture the partitions necessary for the PII theory of Information Structure developed in Chapter 2. In that section, I also discuss the ramifications of these changes to phase theory. One of the more problematic consequences of this general suggestion finds a resolution in section 3.3.3, which suggests how to integrate PICH with Diesing's (1992) Mapping Hypothesis. This proposal represents a new insight into the long-noted apparent correspondence between tripartite semantic structures (i.e., operator-restrictor-nuclear scope) and IS. Based on these developments, section 3.3.4 more sharply defines

how the iCore and iFrame are derived from phases, and provides example analyses to

demonstrate how PICH is able to generate the informational structures argued for in

Chapter 2.

3.3.1   The phase theory of Chomsky (2000, 2001)

In the Minimalist theory prior to phase theory, the derivation proceeds as follows. An

array of lexical items (LIs) are selected from the lexicon in a process called Numeration.

Chomsky (1995) argues that Numeration significantly reduces the computational load of

selecting words from the lexicon. His analogy (from Chomsky 2000) is that if the syntax

has access to the lexicon at any point in the derivation, it is horrendously inefficient, like

a car that carries around its own petroleum manufacturing plant. By restricting syntax to

operate on only a small set of LIs provided by Numeration, the burden of the lexicon is

greatly reduced. Therefore, once Numeration is finished, then no further LIs can be

added to the derivation. When this process is complete, then the operation Merge

applies, taking elements out of the lexical array, two at a time, and combining them into

new units, which are then returned to the lexical array in place of the constituent units.

Movement and other kinds of operations may happen, according to other specifics of the

theory.

          At some point in this process, the derivation reaches the point of Spell-Out.

Spell-Out defines the point of divergence between the derivation that leads to the

interface with the articulatory-perceptual system, known as PF (mnemonic for

"phonological form"), and the derivation that leads to the interface with the conceptual-

intentional system, known as LF (mnemonic for "logical form"). After Spell-Out,

operations that happen on the PF or the LF side are not "visible" to the other side. In

previous theories such as the instantiation known as Government & Binding (GB, cf.

Chomsky (1981) and following work), there is a level of representation called S-structure

(mnemonic for "surface structure") that represents the syntactic structure at the point of

divergence, similar to the point of Spell-Out in Minimalism. However, Chomsky (1995)

is clear to point out that Spell-Out is not a "level" of representation *per se* (that is, there

are no rules of grammar that refer to this representation explicitly), but rather is simply

the point of divergence in the derivation towards sound (PF) and meaning (LF).

This overall architecture is given schematically in Figure 3-2 below.

Figure 3-2: the Minimalist architecture of Chomsky (1995)

Numeration ➜   Lexical Array {some, in, words, a, sentence}

Merge ➜   a + sentence →   a(a, sentence)

Syntactic operations ‑ ‑ ‑ ‑ ➤

syntactic operations
can continue

Spell-Out

phonological
operations

PF   **LF**
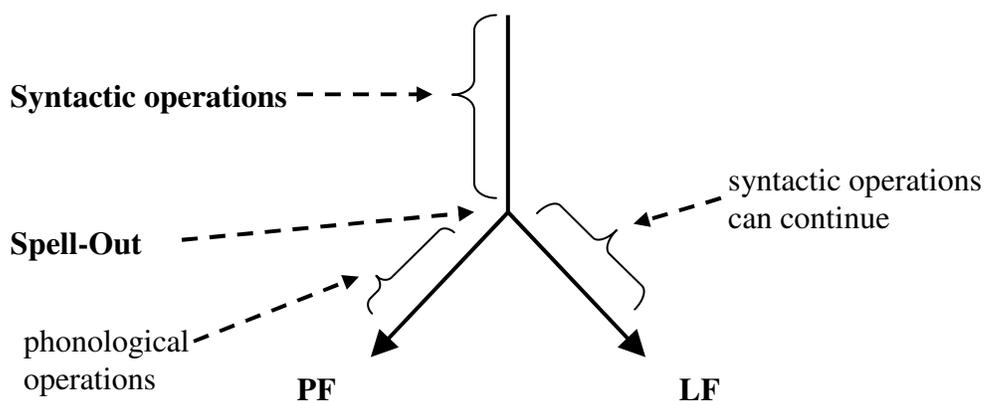
Note that it is possible (though still controversial) that syntactic operations can continue after Spell-Out on the LF "branch" of the derivation. However, any operations – syntactic or phonological – performed after Spell-Out cannot affect or be affected by operations on the other side of the divergence.

The claim of phase theory is that the process shown in Figure 3-2 is cyclic. That is, the entire process from Numeration to Spell-Out and interpretation at PF and LF proceeds in smaller chunks – phases – within a sentence. The original motivations (from Chomsky 2000, 2001)[36] are both theoretical and empirical. Theoretically, Chomsky claims that further subdividing the lexical array into subarrays has a similar advantage as the initial Numeration has over selecting from the lexicon at every step: it reduces computational complexity. Empirically, Chomsky (2000) argues that examples such as (29) and (30) provide evidence that the lexical array is accessed in subarrays.

(29)   There is a possibility that proofs will be discovered.

(30)   There is a possibility that there will be proofs discovered.

The logic is as follows. The Merge operation is less "costly" than the Move operation in computational terms, because Merge is a simple operation of combining two elements into a larger element, while Move requires Merge, plus additional operations, such as the phonological deletion of the lower copy/trace in the chain, and the co-indexing

---

[36] Other proponents of a multiple Spell-Out system may have different motivations. For example, Uriagereka (1999) proposes his Multiple Spell Out theory primarily to satisfy a need for a better linearization algorithm.

requirement between the positions in the movement chain. Therefore, Merge should

always be preferred over Move. It follows from this that the difference between a

sentence with an expletive subject and one without, as in examples (31) and (32), is that

there is part of the lexical array for (31), but not for (32), because if *there* is available for

Merge, that will always be preferred over raising *several linguists*.

(31)   There are several linguists in the room.

(32)   Several linguists are in the room.

This raises the question of why (29) is possible if (30) is, because if *there* is available in

the lexical array (as it clearly is), it should be Merged in the lower clause as in (30)

instead of allowing the more costly raising of *proofs*.

Chomsky's solution is to propose that the derivation proceeds in phases, with

separate selections from the lexical array. The analysis for (29) is that while *there* is

selected from the lexicon in the first Numeration, it is not selected as part of the subarray

that feeds the phase of the lower clause. Since *there* is not available in the lower clause,

raising is possible. It is then selected as part of the subarray that feeds the higher clause,

giving rise to the expletive subject.

The question then arises about what determines the size of a phase. Chomsky

(2000, 2001) proposes that phases be "propositional" in some way. He suggests that this

means "a verb phrase with all θ-roles filled or a full clause including tense and force"

(Chomsky 2000: 106). He argues more specifically that there are precisely two

functional heads, C and *v*, that act as heads of "strong" phases. A strong phase is exactly

the kind of phase we have been discussing; it represents a derivational cycle within a

sentence, drawing from a separate lexical array. The role of "weak" phases is not entirely

clear, and will not be discussed further here, so I will simply use the term *phase* to refer

to strong phases.

      Once phases have been generally motivated, Chomsky finds other uses for them,

especially as providing boundaries and targets for movement. The driving force behind

this is his Phase Impenetrability Condition (PIC), given below.

(33)   *Phase Impenetrability Condition*: In phase α with head H, the domain of H is not
        accessible to operations outside α, only H and its edge are accessible to such
        operations.

In other words, once a phase has been send to PF and LF for interpretation, it becomes

impenetrable to further operations within the phase. Or rather, once the *domain* of the

phase head is sent off to PF and LF, it becomes impenetrable.

      The basic notion of a phase is a unit that is Spelled Out; a unit sent off to PF and

LF for interpretation. However, Chomsky's articulation of this idea is slightly more

complex, in that a phase has three distinct elements: the phase *head*, which is the

functional syntactic head that identifies the phase, the *domain* of the phase head, which is

the impenetrable object described by the PIC, and the *edge* of the phase, which serves as

a kind of syntactic "escape hatch." The roles they play interact as follows. The

derivation proceeds through Merge and Move, until a phase head is Merged. This is a

kind of signal to the syntax that a phase is to be sent off to the interfaces. However, the

unit sent off does not include the phase head, but rather just the complement to the phase

– the *domain* of the phase head. When this unit is sent to the interfaces, it becomes

"inert" to following syntactic operation. The only way for a constituent to escape the

phase and progress to higher movement beyond the phase is to first move to the edge of

the phase, which is essentially the specifier. This analysis is shown graphically in 0,

where H represents the phase head (i.e., C or *v*).

(34)
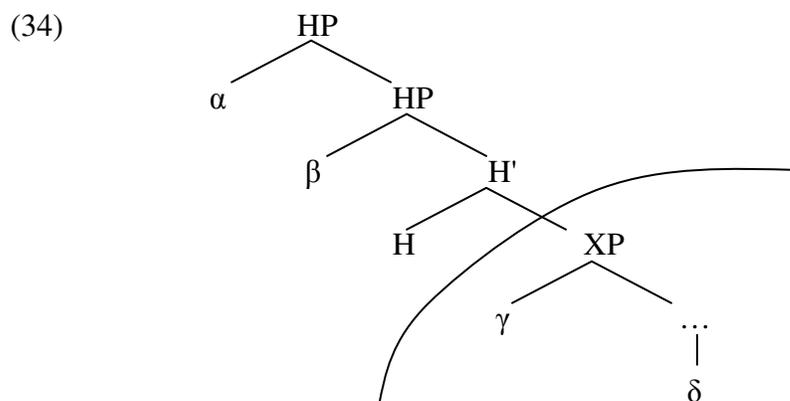
The entire HP is the phase, but the XP below the curve is the impenetrable part.

Chomsky (2000, 2001) assumes that the head H (and therefore the preceding "edge", or

its specifiers) must be visible for selectional reasons, which is why they must be

penetrable to the syntax in later phases. Therefore, if an element in XP (the domain of H)

wants to move to a position higher than HP, it must first travel through [Spec, H] in order

to "escape" the PIC. Otherwise it would be trapped in the phase and rendered invisible to

the syntax in later phases. Depending on what kinds of movements are assumed to

happen out of a phase (e.g., both a subject raising to [Spec, TP] from inside the *v*P and a

direct object *wh*-word raising from inside the VP to [Spec, CP]), it must be assumed that

there are multiple specifier positions available in order to allow multiple "escapees" from

the phase. Because of the PIC, phases clearly play a role in movement phenomena in

general, providing an explanation for why bounding nodes act the way they do, as well as

explaining a number of reconstruction effects (cf. Legate 2003).

3.3.2   Modifying the theory

Given this general background on phase theory, I now propose a modification to the

theory:

(35)   *Phase-Information Correspondence Hypothesis* (PICH)
        Phases are freely assigned in the syntax, and are constrained by interface
        requirements. One interface requirement is the need for Information Structure
        partitions. Therefore, phases map directly to the IS partitions of iFrame and
        iCore.

This is a significant change in the standard phase theory of Chomsky (2000, 2001), so I

will take some time to unpack PICH. First, I will discuss the free assignment of phases

and how phases map to the iFrame and iCore. In the process, I will argue that PICH

solves the problems of previous accounts of the IS-syntax relation which end up violating

the PF-LF divide in some way or another (e.g., violating Inclusiveness). Finally, I will

discuss how this change affects previous work in phase theory.

What does it mean that "phases are freely assigned"? In Chomsky's theory, phases are determined by the category of the functional head just merged. So if *v*P is a phase, then when the *v* is merged into the structure, it acts as a signal to complete the phase and send it off to LF and PF. In PICH, the system is allowed to assign phases to any syntactic constituent at all (including non-maximal projections), and it is assumed that some phase configurations will result in derivational "crashes" at the interfaces (primarily the LF interface). This is arguably a more Minimalist approach than Chomsky's fixed phases, as it is parallel to the Minimalist notion that movement is unconstrained in the narrow syntax, and filtered out at the interfaces.

The critical question, of course, is what the interface requirements are that filter phases. Chomsky's proposal could easily be rephrased in terms of the free assignment hypothesis, because his initial motivation for the identity of phases comes from an interface kind of formulation, namely the idea that phases must be "propositional." However, it is not entirely clear why this would be an interface requirement, because it does not seem to affect interpretation in any way. Presumably, the interface requirements that ensure that all arguments are filled (e.g., the θ-criterion) are not dependent on phases in order to be evaluated. In the following section (3.3.3), I will argue that Diesing's (1992) Mapping Hypothesis provides a better candidate for the CP and *v*P phases that Chomsky proposes, because it does impact interpretation at the C-I interface in a concrete way.

But it is critical to PICH and the overall theory I am arguing for, whether or not "propositional" or any other notion is in fact an interface requirement on phases, that

PICH does not mean that IS provides the *only* interface requirement on phases. I assume

that the interface with the C-I system is fairly complex, and at least involves the

denotational semantics of the entire sentence (via LF), as well as Information Structure

(cf. Figure 2-3, repeated here as Figure 3-3).

Figure 3-3: Alternative model of grammar (IS derived from LF)
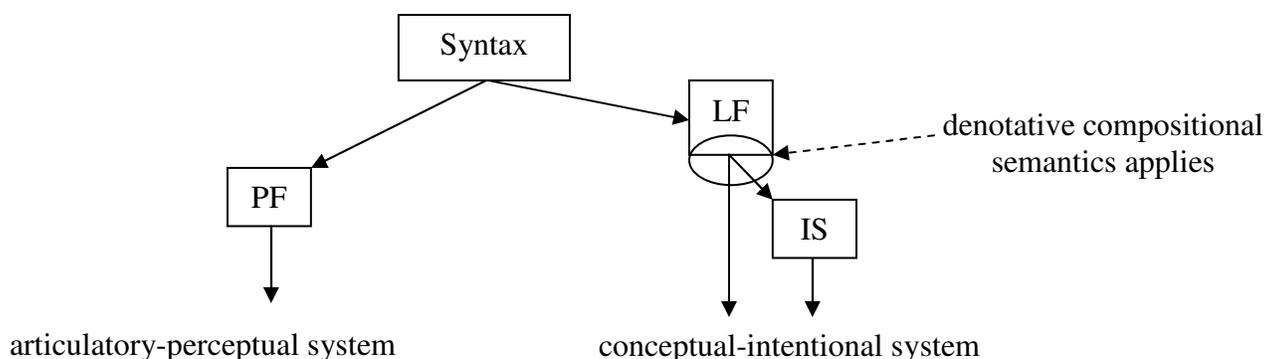
Since we expect the C-I interface to be multifarious, it is natural to expect that multiple

interface conditions could apply to constrain phase configurations. PICH claims that at

least one of these conditions is a need for IS partitions, since without them, the

interpretational system would be unable to assign IS to the sentence. Since IS is a

necessary part of every utterance (there is no such thing as an utterance without IS), this

requires that there be at least enough phases to provide IS with the iFrame and iCore

partitions.

What, then, are the possible phases, and how do those phases get mapped to the

iFrame and iCore? Under PICH as formulated thus far, any constituent can be a phase.

However, at this point, I need to clarify how I am using the term *phase*, because it is

beginning to depart from the usage in Chomsky (2000, 2001). As I noted above, the

Chomsky phase has three distinct regions: the phase (the maximal projection under the

phase head), the domain of the phase head (the impenetrable complement of the head),

and the edge of the phase (the escape hatch for movement outside of the phase). In my

use of the term *phase* I will essentially be referring to something most like the

impenetrable domain of the phase head, in Chomsky's terms. This is because I view

phases as the units that are sent to PF/LF for interpretation, and are thus "inert" in later

derivational cycles. In addition, because PICH assumes that any constituent at all can be

a phase (in my terms), not every phase will necessarily contain a functional head. For

example, a verb could be its own phase to the exclusion of its arguments, and there is no

functional head above V that does not also include the verb's arguments. This of course

also means that not every phase has an available "edge" in Chomsky's sense.

Therefore, unless I refer to a Chomsky phase, what I mean henceforth by the term

phase is a syntactic constituent sent to PF/LF for interpretation, which may or may not

contain a functional head, and which may or may not contain an "escape hatch" edge for

movement out of the phase. However, I will assume that something like Chomsky's

Phase Impenetrability Condition still applies. It merely means that when a phase has an

edge available, it can use it, but if it does not, it cannot.

If any constituent can be a phase, then how are phases mapped to the iFrame and

the iCore? Since the need for an iFrame and an iCore are motivated by interface

properties, I assume that mapping from phases to iFrames and iCores is also motivated by

interface properties. First, I assume that every sentence needs both an iFrame and an

iCore, at least one of each. This is because any well-formed IS at the interface must be able to fill the LINK and EDIT instructions, and the iFrame and iCore provide the denotational content for those instructions. A LINK is necessary, because without it, there is no possible connection between the present statement and the discourse, and that state is informationally ill-formed. Even *non sequiturs* have LINKs, it is just that the leap between the LINK and the listener's actual knowledge state is too large for the listener to overcome, or perhaps simply too large for normal pragmatic expectations of a cooperative discourse. Without any LINK at all, the structure would not just be informationally out of place, it would be informationally uninterpretable. Since interpretability is the prime force behind interface requirements, I assume that this means that LINKs (and therefore iFrames) must exist for every well-formed utterance. The argument for the requirement of an iCore is exactly the same. The EDIT instructions are necessary for informational interpretation, and since they depend on an iCore, the iCore is a necessary part of every utterance.

The next question is how the system decides whether a phase should be mapped to an iCore or an iFrame. It is critical to be very careful here, in order to avoid the very problem I am trying to escape. That is, it might be tempting to propose that there is some feature in the syntax that labels one phase an iCore and another an iFrame. However, this would simply be a reintroduction of the Inclusiveness problem with F-marking which I argued against in section 3.2. Any feature or diacritic that determines a phase for the purpose of IS would essentially be F-marking in a slightly different formulation.

Therefore, the determination of iFrames and iCores needs to fall out of the mechanism itself, which would be more parsimonious anyway.

As a first pass, I propose the Phase-Partition Mapping Principle.

(36) *Phase-Partition Mapping Principle* (PPMP), **first try**
A phase that does not contain an iCore can be mapped to an iCore, and a phase that does contain an iCore can be mapped to an iFrame.

The motivations for this are two-fold. First, it allows iFrames and iCores to be defined configurationally, purely in terms of each other, similar to how lexical categories are interdefined. Second, it establishes the nested relationship such that an iFrame "contains" an iCore. The function of IS, in terms of the theory developed in chapter 2, is to map contributions to discourse into discourse contexts or backgrounds. The contribution element, which feeds the EDIT instruction, is the iCore, and the background element, which feeds the LINK instruction, is the iFrame. The mapping process takes the background as an abstracted property, proposition, individual, etc. and "inserts" the contribution in order to complete the proposition. For example, in our familiar example (37), LINK and EDIT serve to take the abstracted property "things that like cheese" and inserts "Schatzi" as one of those things in order to complete the assertion.

(37)   [$_{Fr}$ [$_{Co}$ SCHATZI] likes cheese]

(38)   iCore: *Schatzi´*

(39)   iFrame: λx. *likes´*(*cheese´* x)

In terms of the mapping to LF, when a phase is Spelled Out and mapped to LF, it is given

a compositional meaning via the semantic component. If this phase does not already

contain an iCore, its meaning can be mapped into an iCore. If the phase does contain an

iCore, it can be mapped to an iFrame. In mapping to an iFrame, however, the iCore(s)

contained in the iFrame are "invisible" to interpretation, and so they are rendered as

variables over which the Frame is abstracted. This is shown schematically in Figure 3-4.

Figure 3-4: Mapping phases to iCore and iFrame

Merge ➔   DP

                                   △
                                Schatzi

Spell Out as phase ➔

                        PF   **LF**
                                           apply
                                           semantics   NO
                                                    Schatzi´

                                           Does phase
                                           contain an iCore?

                                                                        iCore

NEW CYCLE   *Schatzi´*

Merges & Moves ➔ TP

              DP$_j$ T'

        iCore phase   T   *v*P
          Schatzi

                              t$_j$ *v'*

                                    v   VP

                                likes$_i$ t$_i$ NP

                                                         △
                                                       cheese

Spell Out ➔

                PF   **LF**   YES
                                   apply
                                   semantics
                                   likes´(*Schatzi´ cheese´*)

                                                                     iFrame
                                   Does phase contain an
                                   iCore? λx. *likes´*(*cheese´* x)
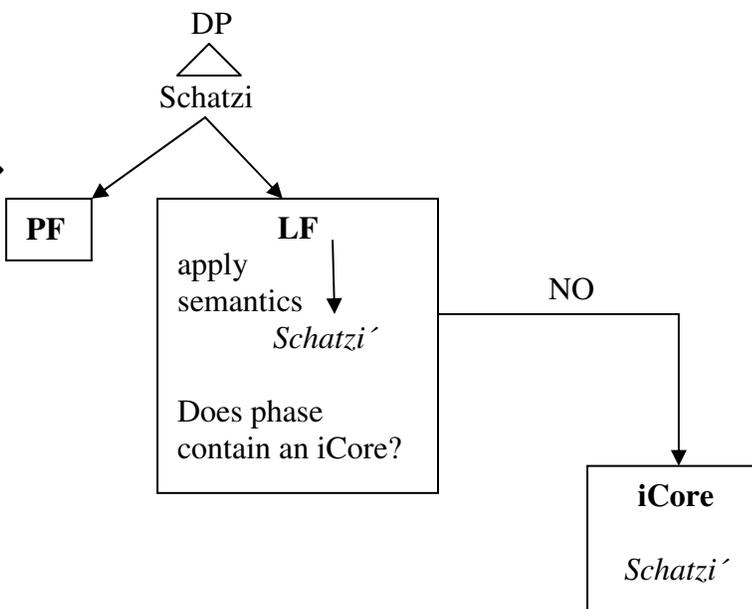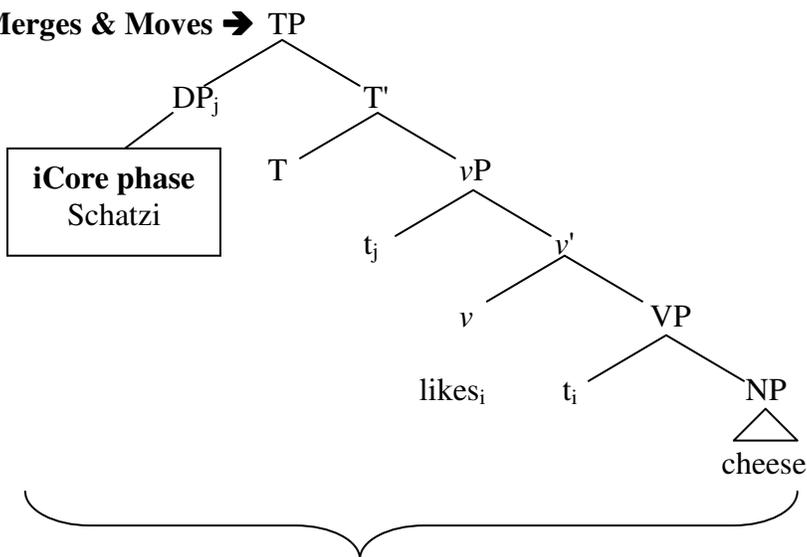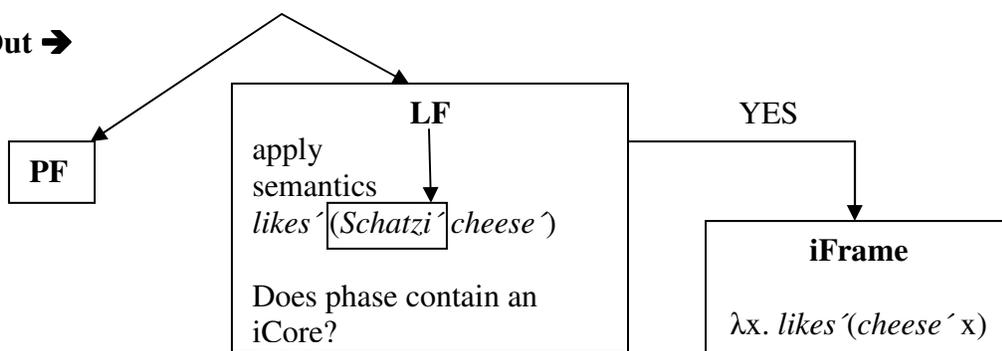
Since the iCore phase is merged back into the structure, and is treated like a single syntactic constituent, it can move as a unit, like any other constituent. In this fashion, any of the IS structures given in Chapter 2 can be generated, simply by changing which constituent is Spelled Out as a phase first. For example:

(40)   [$_{Fr}$ [$_{Co}$ Schatzi likes CHEESE]]

(41)   [$_{Fr}$ Schatzi likes [$_{Co}$ CHEESE]]

(42)   [$_{Fr}$ Schatzi [$_{Co}$ likes CHEESE]]

(43)   [$_{Fr}$ Schatzi [$_{Co}$ LIKES] cheese]

(44)   [$_{Fr}$ [$_{Co}$ SCHATZI] likes cheese]]

(45)   [$_{Fr}$ [$_{Co}$ SCHATZI] likes [$_{Co}$ CHEESE]]

(46)   [$_{Fr}$ [$_{Co}$ SCHATZI] [$_{Co}$ LIKES] cheese]]

There are several things worth commenting on regarding these structures, which I have put off until now, when we have finally proposed a relation between IS and syntax.

First, the structure in (40) is slightly deceptive, in that it appears that the iFrame and iCore are completely co-extensive. This is not quite the case. This represents the so-called "out-of-the-blue" IS. This IS is often referred to as "default", "all-focus", "unmarked", "all new information", etc. For consistency, I will refer to such IS configurations as out-of-the-blue (OOTB). The idea is that the entire proposition is new to the discourse, and so it must all be inside the iCore (or focus, or new information, etc.).

However, I assume that interface requirements make a truly "all iCore" sentence such as (47) impossible.

(47)   [$_{Co}$ Schatzi likes CHEESE]

For one, as I have already argued, an utterance without an iFrame is informationally uninterpretable, and thus will crash at the C-I interface. But I also assume that the interface requires that the iFrame and iCore have some kind of content. If the iCore truly covered the entire utterance, the Frame value would simply be a variable, which is virtually contentless. This problem is clearer when we consider what the alternative set is that such a Frame would represent, namely the entire universe of the language.

So what if anything is inside the iFrame but outside the iCore in (40)? Here, I follow Herburger (2000) in a Neo-Davidsonian analysis, such that there is always an event operator present in an utterance, and this is the element outside the iCore in an OOTB sentence. One supporting piece of evidence for this is that "what happened?" is the canonical "context question" used to evoke an OOTB sentence. This question presupposes that an event occurred, and is asking about what that event was, in just the same way as "what does Schatzi like?" presupposes that she likes something, and is asking about what it is. Thus, I assume there is always an implicit event operator inside the iFrame but outside the iCore in OOTB sentences. However, for simplicity, I will usually leave this out of the IS representations.

Example (45), repeated here as (48), also requires some comment.

(48)   [$_{Fr}$ [$_{Co}$ SCHATZI] likes [$_{Co}$ CHEESE]]

This structure is a multiple iCore (a.k.a. multiple focus) structure, which I mentioned above in section 3.2 during the critique of Rizzi (1997). It can be interpreted as a pair-list answer, or simply as presenting two new pieces of information, as described above. The only thing of note here is that it is actually unremarkable in terms of the PPMP. Since neither iCore is contained in the other, it is a perfectly "legal" and interpretable IS.

Finally, consider that while it is possible for both the subject and verb of a sentence to be "in focus", it is not possible for them to be in the same iCore ((46) is repeated here as (49)):

(49)   [$_{Fr}$ [$_{Co}$ SCHATZI] [$_{Co}$ LIKES] cheese]]
(50)   * [$_{Fr}$ [$_{Co}$ SCHATZI LIKES] cheese]]

The reason that (50) is not allowed is simply that *Schatzi likes* is not a syntactic constituent.

Interestingly, (50) is exactly the kind of structure that Steedman (2000, 2001) proposes for the answer to a question such as (51).

(51)   What do you know about cheese?

This is important for Steedman, because he takes this to be direct evidence for the syntactic theory of Combinatory Categorial Grammar (CCG). One of the distinguishing characteristics of CCG is that it allows rather flexible constituent structures, and so subject-verb can just as easily be a constituent as verb-object. Since Steedman claims that IS is isomorphic with syntactic structure, he uses data such as this to buttress the constituent claims of CCG.

However, there appears to be a critical piece of evidence related to IS that argues against Steedman's claim that (51) is properly represented by (50), not (49). Namely, if we assume that *only* associates its meaning (i.e., its EDIT instruction, see section 2.10) with an iCore (or rheme, in Steedman's terms) that it c-commands, then CCG appears to make the wrong prediction for the following:

(52)   Only Schatzi likes cheese.

When *only* precedes the subject, it can only associate with the subject; it cannot associate with the subject + verb, no matter how the verb is stressed. That is, (52) must mean "the only individual that likes cheese is Schatzi." It cannot mean "the only thing about cheese is that Schatzi likes it," no matter what the stress pattern is. CCG appears to be completely unable to explain this, given that it makes the precise prediction that *Schatzi likes* can be treated as any other constituent, and if *only* can associate with an object + verb in a sentence like (53), it must be able to associate with a subject + verb such as in (52).

(53)   [Fr Schatzi only [Co eats CHEESE] all day]

But clearly this prediction is not borne out. It is unclear how CCG can account for these facts. Thus we have an empirical basis for preferring the current theory over Steedman's, even though I share many of the same ideas, such as a kind of syntax-IS correspondence, the use of boundary tones as lexical items, and the incorporation of different boundary contours with different IS meanings.

To conclude this section, we must discuss how PICH affects the "standard" phase theory of Chomsky (2000, 2001) and following work. A comprehensive review of all phenomena to which phase theory has been applied is beyond the scope of this thesis. However, I will address both the specific initial evidence garnered for phases, as well as claims about more general issues such as how my revision interacts with the use of phases as both a means for and constraint on movement. I conclude that the interface requirement suggested by PICH is not sufficient to explain the entire distribution of phases. However, in the following section (3.3.3), I will suggest an additional interface condition, based on Diesing's (1992) Mapping Hypothesis, which if taken together with PICH can overcome this problem.

The insufficiency of PICH alone is immediately evident on considering data such as (29), repeated here as (54).

(54)   There is a possibility that proofs will be discovered.

Recall that Chomsky's (2000) argument is that since *there* does not have to be merged

into the subject position of the lower clause, even though merge is always "cheaper" than

moving *proofs*, it must be an indication that *there* is not actually available for merge at

that point in the derivation. Phase theory provides an explanation for this unavailability

by claiming that 1) access to the lexical array is limited to subarrays that may be different

for each phase, and 2) that the lower clause is in a different phase than the higher clause.

If we assume something like PICH, requiring a phase boundary at the clause boundary

becomes difficult or impossible, given the apparent IS of the following example.

(55)   A: It is certain that proofs will be discovered in the current line of research.

B: No, [$_{Fr}$ there is a [$_{Co}$ POSSIBILITY] that proofs will be discovered] – there is no
guarantee.

Assuming that the marked IS partitions are correct, the minimal phases required by PICH

would include *there* in the same phase as the lower clause, thus taking away the

mechanism for explaining why moving *proofs* is allowed instead of simply merging *there*

in again, as in the following.

(56)   [$_{Fr}$ There is a [$_{Co}$ POSSIBILITY] that there will be proofs discovered]

Of course, as PICH is currently formulated, it is possible for the system to generate many

more phases, which could give the desired result of a phase boundary between the lower

and higher clauses. So looked at more generally, the problem this data raises for PICH is how to *require* the system to create more phases. That is, the minimum phases needed to articulate the IS partitions argued for in Chapter 2 do not seem to be enough, in order for this system to account for the original data that inspired Chomsky (2000, 2001).

Another potential problem is the converse of the above, namely that PICH may predict too many phases. Since phase assignment is "free", we might expect that the system would generate phases where the syntactic evidence suggests there is no phase. One of the primary sources of evidence for phases comes from diagnostics for movement. For example, Legate (2003) uses data from reconstruction effects, quantifier raising, and parasitic gaps to argue that passive and unaccusative *v*Ps are phases, *contra* Chomsky (2001), who argues that only transitive *v*Ps are phases. The logic is that phases (in the Chomsky sense) force movement to their edges, because those are the only sites for movement that will allow a constituent to escape the phase to move higher. Thus, there should be some kind of evidence for movement to the edges.

However, in practice it is hard to demonstrate that a given constituent *cannot* be a phase. The list of functional heads proposed as phases has tended to proliferate (e.g., passive and unaccusative *v*P in Legate 2003, each argument of a verb in Barss & Carnie 2003 and Carnie 2005, DP in Adger 2006), but few arguments can be found ruling out candidates for phasehood. This may be because phases simultaneously create a syntactic island and a route for escaping that island.

In any case, generating an overabundance of phases is a relatively easy problem to resolve for PICH. We simply need to adopt some kind of economy constraint on phases,

which seems appropriate given the interface nature of phases. That is, one interface requirement of phases should be that a phase is ill-formed unless it ends up contributing to interpretation in some way. Under this view, interface requirements do not just require that certain phases exist, they require that only those phases exist. If PICH is the only operating interface condition on phases, then this would mean that the only phases allowed would be ones that resulted in distinct informational interpretations at the interface. I will assume this is true, lending theoretical support for the methodological perspective of assuming that a phase does not exist without sufficient evidence.

The problem for PICH is that this apparently only worsens the problem with under-generation of phases. Namely, the "standard" CP and vP phases, especially the vP phase, will be left out whenever they do not correspond to an iCore or iFrame. In the following section, I propose an additional interface requirement on phases, based on Diesing's (1992) Mapping Hypothesis, which resolves this problem.

Before leaving this section, a brief summary is in order. I have proposed here that the notion of derivational phase provides an ideal mechanism for creating the IS partitions of iFrame and iCore as argued for in chapter 2. Phases appear to map neatly to the nested structure of iFrames and iCores, and they provide a means of encoding IS in the syntax indirectly, without a need for F-marking or "focus movement" of any kind. Furthermore, the Phase-Information Correspondence Hypothesis (PICH), perhaps taken along with some constraints against vacuous proliferation of phases, provides a clear interface-driven means to formulate phases, without having to appeal to notions such as Chomsky's (2000, 2001) "propositional" requirement of phases, arguably making the

phase mechanism more Minimalist than even its original formulation. However, an

apparently serious problem has arisen, in that PICH does not seem to require enough

phases. The following section addresses this problem.

3.3.3   IS and the Mapping Hypothesis

Diesing's (1992) Mapping Hypothesis is a claim about the correspondence between

syntax and interpretation. Her primary empirical concern is the interpretation of

indefinites, and the application of the tripartite structures of the Heim-Kamp tradition.

Specifically, a tripartite structure in this sense is the basic semantic division in a

quantificational structure. Consider the following.

(57)   Every dog likes cheese.

This sentence can be viewed as having an operator, with a restrictor and nuclear scope,

such that the operator is the quantifier *every*, the restrictor is the noun *dog* which restricts

the set over which *every* applies, and the nuclear scope represents the domain in which

the restricted set is substituted in order to return a truth value. Thus (57) can be

paraphrased as (58).

(58)   For every x, such that x is a dog, x likes cheese.

       operator   restrictor   nuclear scope

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The claim regarding indefinites following Heim (1982) is that an indefinite within the

nuclear scope is interpreted existentially, while an indefinite outside the nuclear scope is

given a "strong" reading (following the terminology of de Hoop 1992) such as a generic.

This is exemplified by the ambiguity in bare plurals. Consider the following from

Diesing (1992):

(59)   Firemen are available.

This sentence can either refer to some particular firemen that are available (the existential

reading), or it can be read as attributing *available* as a property of firemen in general (the

generic reading). In the former reading, *firemen* is interpreted in the nuclear scope, and

in the latter, in the restrictor.

        Diesing (1992) makes the further claim that there is a straightforward mapping

between tripartite structures and the syntax. She articulates her theory thus:

(60)   *Mapping Hypothesis*
        Material from VP is mapped into the nuclear scope.
        Material from IP is mapped into a restrictive clause.

Of course, some assumptions about phrase structure have changed since then, but for our

purposes, I assume that the VP is still the unit mapped to the nuclear scope, and that the

TP is the unit mapped to the restrictive clause. The analysis is basically that if a noun

phrase such as a bare plural gets interpreted within the VP, it gets an existential reading, and if it gets interpreted higher up, in the TP, it can get a generic reading.

In the previous section (3.3.2) I argue that phases should be determined by interface conditions, and propose that the need for IS partitions is one such condition. Here, I propose that the Mapping Hypothesis provides the motivation for another. In particular, I propose that both the nuclear scope and the domain for the restrictive clause must be sent to LF for interpretation as phases, in order for the Mapping Hypothesis to be evaluated properly in the system.

The first thing to note is that this provides an independent reason to enforce Chomsky's (2000, 2001) original CP and vP phases, and thus returns the inventory of phases to a more traditional state. Recall that I am using the term "phase" to refer to the impenetrable chunk sent off to the interfaces, which for Chomsky is the phase complement. Thus, my claim that VP and TP are phases is exactly equivalent to Chomsky's claim that CP and vP are. With an independent reason to expect that regardless of IS, VP and TP will always be phases (in my sense), the biggest problem with PICH is solved, because now it has a means of capturing the original *there* distribution data, as well as all other evidence (reconstruction effects, etc.) that these phases are always part of the derivation.

This claim also gives us some empirical mileage in explaining a series of interesting stress facts, but these will have to wait until Chapter 4, when the information-stress relationship is fleshed out. As a short preview, there is a generalization such that in OOTB contexts, stressed elements get interpreted as if they were low in the structure,

because they are inheriting the stress from an earlier cycle of stress assignment. Constituents in narrow iCore information structures have more freedom in interpretation, because their phasal status will result in stress assignment, regardless of where they are interpreted.

Barss & Carnie (2003), Carnie & Jelinek (2003), and Carnie (2005) make a related suggestion regarding a match between phase domains and the Mapping Hypothesis, but end up proposing multiple Mapping Hypothesis domains, along with separate phase domains, one for each argument of a verb. As far as I can tell, my analysis here and in Chapter 3 regarding the Diesing-style Mapping Hypothesis would be unaffected by the adoption of Carnie et al.'s more articulated version. If Carnie et al. are correct, then this represents yet another interface condition that affects phasing. As such, it is entirely in line with PICH and the rest of the theory developed here.

This "tolerance" can be generalized, to note that the formulations of PICH and the PPMP that determine which phases must be built and how they are mapped to particular IS partitions are perfectly happy coexisting with additional interface requirements on phases, as long as those additional requirements are merely additions, and not actual restrictions on which constituents can be phases. If we expect that economy constraints act to keep the number of phases as low as possible without loss of interpretability, then we expect precisely this, that additional interface requirements would exist only to enforce additional phases, not to take phases away. That is, if we already assume a condition of "as few phases as possible for interpretation", then any other interface condition that took away phases would be creating uninterpretability. Given that the sole

reason for interface conditions to exist is to eliminate uninterpretability, it would seem that we are safe. PICH enforces the minimum phases needed for IS, and the phase-based Mapping Hypothesis enforces minimum phases that correspond to the original Chomsky (2000, 2001) phases. Enforcing additional phases does not conflict with PICH or the PPMP. The sum picture is that the apparently radical PICH is much less radical in practice, as it conflicts will little or no previous empirical claims about the location of phases.

3.4   Summary and conclusions

In this chapter, I have taken on the task of proposing a means to represent IS partitions in the syntax without violating the T-model or related Minimalist principles such as Inclusiveness. I argue initially that all feature-based models of IS, the so-called F-marking models (following Jackendoff 1972), violate these principles in some way or another. I further argue that purely movement-based theories of IS representation (such as Rizzi 1997) either inherit the same problems as F-marking, or have problems of their own.

As a potential solution, I offer the Phase-Information Correspondence Hypothesis (PICH), which states that phases are freely assigned in the syntax, subject to interface conditions, and that one such condition is a need for IS partitions. I have shown that this mechanism is able to provide precisely the IS partitions argued for in Chapter 2 (the iFrame and iCore).

I noted that this revision to phase theory does not come without consequences, and in particular seems to run into trouble because it does not require enough phases. However, once we add additional interface requirements (which would be expected) such as a phase-theoretic version of the Mapping Hypothesis, this problem is resolved. Once the interface system is enriched beyond just the PICH, it appears that the actual revisions required by PICH are few, allowing PICH to coexist comfortably with a wide range of current work on the identity of phases, in addition to the original formulations from Chomsky (2000, 2001).

In conclusion, by recasting phase theory to accommodate Information Structure, we appear to have improved the original theory, by giving it still more empirical weight via an analysis of IS, and by giving it a clearer motivation. Namely, that phasing, like movement, is freely generated by the narrow syntactic machine, and constrained by interface conditions on interpretability.

CHAPTER 4

INFORMATION AND SOUND

4.1   Introduction and overview

We have come finally to the last piece of the Information Structure (IS) puzzle: how

does IS relate to phonology? In the context of the theory developed thus far in this

dissertation, this question already has an answer, or rather, two answers. On the one

hand, tonal contours are treated as lexical items whose "meaning" affects informational

instructions such as LINK, as detailed in chapter 2. On the other hand, stress assignment

has not yet been addressed, but it must follow from the phase articulation proposed by the

Phase-Information Correspondence Hypothesis (PICH). Most of this chapter will focus

on detailing stress assignment, but in short, I propose that it proceeds mechanically in a

cyclic manner, where syntactic phases provide the cycle. Since phases are tied to IS via

PICH, the result is a unified account of stress assignment for cases that have traditionally

been separated into "default" or "structural" vs. "exceptional" or "focal" stress. In a

sense, my claim is that all stress assignment is related both to structure and information,

and the distinction between structurally-determined stress and informationally-

determined stress is an unnecessary complication.

The rest of this chapter proceeds as follows. Section 4.2 covers the fundamental

terminology and assumptions about prosodic structure that form the basis of the

discussion. Section 4.3 discusses the role of boundary tones in my theory, comparing my

approach with Steedman's. In Section 4.4, I discuss the issue of nuclear stress placement,

first reviewing the major approaches in the literature, and then working out the details of my approach. Section 4.5 addresses some residual issues, and conclusions are given in Section 4.6.

4.2   Prosodic fundamentals

I assume a basic theory of prosodic representation along the widely-accepted lines of Liberman (1975), Pierrehumbert (1980), Gussenhoven (1983, 1984, 2000), Selkirk (1984, 1995), Pierrehumbert and Beckman (1986), Truckenbrodt (1995, 1999), Ladd (1996), Steedman (1991, 2000), etc., which can be loosely labeled an Autosegmental Theory of intonation. There are essentially two prosodic dimensions in this theory: a system of stress and prominence assignment, and a system of tonal pitch contours.[37]

There are many interesting debates within this general framework, such as whether stress assignment precedes tonal alignment (e.g., Liberman 1975 and Pierrehumbert say yes, Selkirk 1984 says no), but I will ignore most of these issues, as they are largely orthogonal to the thrust of the current discussion. I will simply assume the following. On the one hand, not all constituents in an utterance have equal phonological prominence, or *stress*. Of course it is also true that within individual words, not all syllables have equal prominence either. We will largely ignore word-level stress, though, and concentrate on how relative prominence between words is assigned. It

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[37] In some theories (e.g., Selkirk 1984, Nespor & Vogel 1986), prosodic constituency (phrasing) is an important dimension. However, the issues that distinguish prosodic constituent theories from "purely" autosegmental theories are not at issue in this work. Clearly, my theory would predict that phases line up with prosodic phrasing in important ways (though not in completely isomorphic ways), and I assume that the arguments presented here will carry over to theories that assume phrasing as a primitive, though this is a topic in need of further research.

should be noted that in most cases, sentence-level stress "attracts" to word level stress.

Take the following example:

(1)   A: I brought you some cough syrup.

(2)   B1: But I wanted some ASPIRIN!

(3)   B2: But I wanted some ECHINACEA!

In both (2)and (3), the last word in the sentence receives the most prominence, but the exactly location of the prominence is still dependent on the location of word-level stress in that word. Thus the most prominent *syllable* in each sentence is the underlined one above, which aligns with the word-level stress of *aspirin* and *echinacea*, respectively. Since this distinction is not at issue in the discussion, I will follow the convention of showing prominence on the word in general, even if there is really only one syllable in that word that is especially prominent.

In addition to stress assignment, sentence prosody also utilizes tonal contours. Following the tradition of tone analysis of early autosegmental work on lexical tone (e.g., Leben 1973, Goldsmith 1976), tonal contours are thought to decompose into a sequence of discrete H(igh) and L(ow) tones.[38] The alignment and phonetic realization of these tones is a source of ongoing research. However, as mentioned earlier in chapter 2, there is generally a distinction drawn between (in the terminology of Pierrehumbert 1980 and

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[38] In the original Goldsmith & Leben style theories, other primitive values for tones were allowed, such as M(id). However, following Pierrehumbert (1980), autosegmental theories of intonation typically only posit H and L tones.

following work) *pitch accents* and *boundary tones* (sometimes also called *phrase accents*). The major distinction is that pitch accents are aligned with stress, while boundary tones are not, but are rather aligned at the edge of some constituent. In the widely-used Tones and Break Indices (ToBI) system of intonational notation (Silverman et al. 1992, Beckman & Hirschberg 1994), pitch accents are labeled with "*", intermediate phrase accents are labeled with "-", and boundary tones are labeled "%".[39] Consider the following.
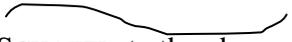
(4) SCHATZI ate the cheese
     H*   L-H%
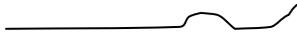
(5) Schatzi ate the CHEESE
                      H* L-H%

Both utterances contain the tonal contour HLH, where the first H is a pitch accent (H*), the L is a phrase accent (L-) and the second H is a boundary tone (H%). Note that when the primary stress shifts from *Schatzi* to *cheese*, the pitch accent also shifts in order to stay aligned with the stress, while the L-H% tonal contour remains more or less the same, aside from the "compression" of the duration of the L- tone in (5), due to the closer proximity of the preceding H*.

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[39] The distinction between phrase accent "-" and boundary "%" tones is largely theoretical, but the general assumptions are that boundary tones only occur at the edge of the largest prosodic constituents, while phrase accents are able to occur at the edges of smaller constituents as well. Furthermore, it is assumed that wherever a boundary tone exists, a phrase accent must also exist, preceding the boundary tone.

In what follows, I will have very little to say about the tonal identity of pitch accents (i.e., whether they are H*, L*, L+H*, L*+H, or whatever), not because this has no possible importance, but because it takes us into issues of phonetic and perceptual distinguishability that would lead us too far a field. Therefore, I will address just two core aspects of prosodic representation: boundary tones, and the alignment of stress.

4.3   Boundary tones

As discussed briefly in chapter 2, I claim that boundary tones should be analyzed as lexical items, whose meanings have a direct effect on the instructions component of IS, such as LINK. This follows Steedman (2000) in spirit, though not in the details. Other theories (e.g., Pierrehumbert & Hirschberg 1990) analyze the meaning of boundary tones in different terms, such as speaker attitudes and implications. It is beyond the scope of this dissertation to comprehensively argue that boundary tones only represent informational instructions. However, I will note that the meanings of boundary tone contours are always defined in terms of inter-speaker communication. I speculate that the simple linguistic functions of boundary tones are to affect how information is suggested to the listener (via the instructions), and that all of the other higher-level attitudinal and pragmatic functions associated with boundary tones are derivable from these simple functions.

For example, Pierrehumbert & Hirschberg (1990) claim that the L-H% contour conveys something like "incompleteness", while I claim that it has a specific effect of

asking the listener to access a negated existential form of the Frame as part of the LINK operation. Consider the following:

(6)   SCHATZI likes cheese
        H*   L-H%

The "incompleteness" analysis is attractive here, because there is a sense of open-endedness to this comment, such that the speaker is not trying to say one way or another whether other people in fact do like cheese. Under my analysis, the speaker is simply claiming that "no one likes cheese" is false, because Schatzi does. This also leaves the status of other cheese-likers open, because it is merely aimed at pointing out that the set of cheese-likers is not the null set. On the other hand, there is a clear sense that this contour is doing precisely what my analysis calls for, which is not easily captured by the "incompleteness" analysis. For example, if you wanted to express your affections to someone, but wanted to leave open the possibility that other people might feel the same way, you would probably not utter the following out of the blue:

(7)   I love you
        H*   L-H%

This would only be appropriate in a discourse in which "no one loves (the listener)" is already active. By uttering it out of the blue, the speaker is suggesting that that proposition *should* be active in the discourse, which implies that the speaker either thinks

that the listener has poor self-esteem, or that most other people do not love the listener, neither of which is a particularly nice thing to imply. This "pity" reading comes about straightforwardly in my theory because of the LINK to the proposition "there is no x such that x loves you", but it is not clear how a general notion of "incompleteness" could give rise to this reading.

Clearly, there is a great deal of further research necessary to establish how robust this pattern is, but for now, I will speculate that the basic "meaning" of boundary tone contours is to adjust the LINK operation in some way. This adjustment itself can give rise to a rich set of pragmatic implicatures, because LINK can be used to establish what the speaker expects to exist in the active discourse background. This gives the speaker simultaneous control over the assertion (i.e., the proposition denoted by the utterance) as well as the context in which the assertion should be considered (i.e., the virtual knowledge state of the listener), which can be combined to give rise to a great many subtle implications and pragmatic gestures.

A more critical issue for our present purposes is the notion that boundary tones are lexical items introduced into the derivation during Numeration. This is a key claim that will allow my theory to maintain a strict T-model of grammar, because it ensures that at least the meaning conveyed in this aspect of prosody is through the lexicon, not through prosody itself. That is, IS does not need to interpret a phonological representation, but rather a lexical representation, which happens to be spelled out tonally rather than segmentally.

This proposal raises several interesting questions. The most pressing question is where exactly boundary tones belong in the syntax. That is, if they are lexical items and must be Merged into the structure just like any other lexical item, where are they Merged? I claim that they are Merged into functional head positions somewhere in the left periphery around (possibly even above) C. There are two reasons for this claim. First, if we follow Rizzi's (1997) suggestion that there are positions representing illocutionary force in the left periphery, then this seems like the natural place for boundary tones to reside, since they are definitely associated with things like illocutionary force (e.g., tones to signal questions). Second, in terms of the theory developed in Chapter 2, the interpretation of boundary tones is in formulating the LINK operation, which critically depends on the iFrame constituent. Since the iFrame must contain the largest sentential constituent (because everything must be inside *some* iFrame, in order to be interpretable at the IS interface), then it makes sense that the boundary tones would delay Merging until the point where they can be interpreted, that is, at CP.

In turn, this proposal raises several serious questions. First, the reader may be perplexed as to why I would invoke Rizzi (1997) after trying to argue against him in section 3.2. The answer is quite simple. In section 3.2, I argued against the idea of IS-driven movement of constituents to Focus positions. This is important for my theory, because I am claiming instead that the mechanism of phase, not movement, creates the IS for Focus (which I call iCore). However, this does not mean that there cannot be functional heads of different types in the left periphery, such as Rizzi's (1997) ForceP. My arguments were not directed against left-periphery functional heads in general, but

rather just Rizzi's proposed functional heads for Focus. Therefore, it is not at all

inconsistent to claim that the iCore remains *in situ*, and does not need to raise to any kind

of Focus head in the left periphery, but boundary tones, which themselves are essentially

lexical heads that affect illocutionary force, do in fact belong in left-periphery positions.

The next serious question is more of an empirical matter. If all boundary tones

are in (or around) C, what about cases in which there is only one boundary tone for

multiple CPs, or cases where there are more than one boundary tones for just one CP?

That is, how does this proposal deal with the following:

(8) [CP You told Mary [CP that John was MARRIED?]]
                                  H*   H-H%

(9) [CP It's impossible to be HAPPY in this world   without a good pair of SHOES.]
                          H*   L-H%   H*   L-L%

Resolving the first case, where there are more CPs than boundary tones, is relatively

straightforward. CPs themselves do not require boundary tones. Boundary tones are

necessities for iFrames. So a CP without a boundary tone is not ill-formed, but an iFrame

without one is. So as long as no iFrame is without a boundary tone in the left periphery

of the highest clause of its domain, then the interface is happy.

But if the H-H% contour is Merged in around C of the highest clause in (8), then

how does it end up in its phonological position at the end of the sentence? Here is where

the special phonological nature of boundary tones plays a role. If we assume the need for

linearization according to structure is an interface requirement of PF (Chomsky 1995),

then it is clear that that requirement should not apply to boundary tones, since it is in fact impossible for boundary tones to be linearized in relation to the rest of the segmental string. Therefore, we cannot expect much help from the PF "position" of boundary notes to reveal anything about their syntactic position. In other words, just because the H-H% is in a high syntactic position does not prevent it from being pronounced anywhere, since it is effectively "outside" or "parallel" the segmental string. I assume that this is where PF plays a major role, in determining for a given language where and how boundary tones are phonetically realized within their domain.

The case exemplified in (9), where there is more than one boundary tone contour in one CP, is a bit more complicated. First, if I am assuming that boundary tones are in the left periphery, I must assume that they can iterate, such as in the following structure:[40]

(10)

```
CP
  C'
C     ToneP
        Tone'
     Tone    ToneP
     L-L%       Tone'
             Tone    TP
             L-H%
```

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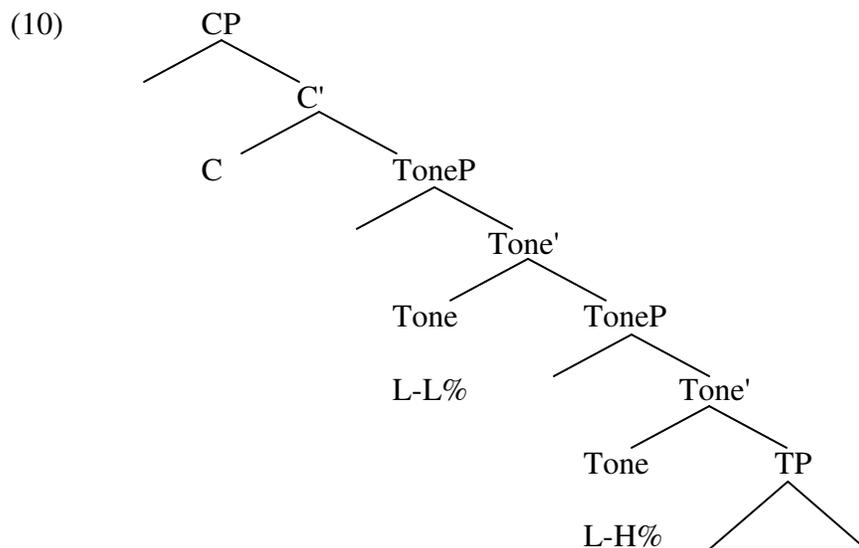
[40] I will use the term Tone Phase (ToneP) to stand in for the label of the functional head that the tones represent. Ultimately, a label such as ForceP may be more accurate.

This means that there could be an arbitrarily large "stack" of boundary tones in the left periphery. I assume ruling out impossibly large numbers of tones is a job for the phonology, since at some point it becomes impossible to pronounce so many tones over limited segmental material. The more difficult and critical question is how the tones are distributed and interpreted, because this bears directly on the architectural issues that motivate this thesis.

For example, it is clear that though there are factors that constrain the placement of intonational phrasing and boundary tones in CP-internal positions (cf. the Sense Unit Condition of Selkirk 1984), there is some freedom in that positioning. For example, the sentence in (9) could also be produced with a different internal phrasing as in (11).

(11)   [CP It's IMPOSSIBLE   to be happy in this world without a good pair of SHOES.]
            H*   L-H%   H* L-L%

On the other hand, it is also clear that whatever the exact informational contribution of each of the boundary tones in (9) or (11), switching their order makes a big impact on the informational interpretation. Therefore, their distribution must be somewhat controlled.

And here is where things get sticky. We might be tempted to affix some kind of label to each of the tones, to dictate where they must be pronounced. However, this would undo all the work we have done in preserving the T-model, because it would essentially be the same as F-marking, because it would represent a diacritic feature introduced merely to make sure that PF and LF/IS are coordinated. So instead, I suggest that the hierarchical order of the boundary tones themselves should decide how they are

arranged. This makes the interesting prediction that the only thing dictated by the syntax is the *relative* positioning of the tones (i.e., which tone is sentence- or clause-final and which is clause-internal). This allows for the long-observed mismatches and imperfect alignments between syntactic constituents and intonational phrases. Determining exactly what principles guide intonational phrasing is a separate issue, far out of the scope of the current work. The claim here is simply that those principles are potentially – though not necessarily – independent from the identity of and relationship between the boundary tones within a single clause.

This proposal in turn raises additional questions related to my overall phase-based theory of IS. In particular, since there are typically (and probably obligatorily) phases smaller than CP within each CP, and since all boundary tones are Merged very late, up around C, then it follows that when the lower phases are Spelled Out, they are not specified for intonational contour. This is potentially a problem, if the claim about phases is that each phase is completely well-formed at both the PF and LF interfaces, because presumably a phonological unit without any specified intonation is not well-formed.[41]

There are a few potential solutions to this dilemma. First, there might be some kind of "default" intonation applied at PF to phases that do not yet have tonal specification. However, this seems to be a non-optimal solution, because this default intonation will necessarily be over-ridden in every utterance, since every utterance needs a lexically-represented boundary tone for reasons of IS interface (i.e., in order to supply

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[41] Thanks to Andrew Carnie and Mike Hammond especially for this point.

the LINK instructions, which are lexically specified by the tones). Another possibility is that in fact, intonationless phases are not uninterpretable at the PF interface, and the reason that all sentences have some intonational contour is not due to a PF requirement (which might be evaluated every phase), but rather to an IS requirement (which would be evaluated at the determination of the iFrame, when the boundary tones *are* available). A final possibility is that while some phonological processes are cyclic (as in the stress assignment discussed in the next section), the determination of intonational phrasing, especially within the CP, is post-cyclic.

I suggest that the answer is some combination of the latter two suggestions. First, even in the most conservative version of phase theory, intonational phrasing can cut across phases. An example from Selkirk (1984) with the intonational phrasing in (12) would have the phase structure in (13).

(12)   (Mary prefers) (corduroy)

(13)   [Mary [prefers corduroy]]

This demonstrates that it cannot be the case that full intonational specification must happen at each phase cycle, because otherwise the phonology would have to build a defective "phrase and a half" intonational structure during the first phase [*prefers corduroy*], and then somehow meld *Mary* into that structure later in order to produce the right phrasing.

Given this basic mismatch between phases and intonational phrasing, we must conclude that the determination of phrasing does not need to follow a strict phase cycle. Taken along with my proposal that boundary tones are merged high into the syntactic structure, and would not be available until later phases anyway, this post-cyclic view of intonational phrasing makes sense. We are left with the conclusion that intonationally underspecified phases are not ill-formed at the PF interface. However, this raises a whole host of related questions. What about phonological processes (e.g., *liaison* in French, *raddoppiamento sintattico* in Italian, tone sandhi in Mandarin) that are thought to depend on prosodic phrasing, which in turn aligns with syntactic structure? If intonational phrasing is post-cyclic (in terms of the phase cycle, not the word cycle), are these processes post-cyclic as well? At this time, it is unclear to me how to test this question empirically, and a thorough theoretical investigation is out of the scope of the current work, but clearly these are important questions that are raised by the current proposal about intonational phrasing, with substantial consequences for the overall theory I am defending.

In summary, in order to achieve straightforward correspondence between the identity of a boundary tone and its impact on IS, I have hypothesized that boundary tones are represented lexically, and merged into the syntactic structure for interpretation. In this section, I defended the idea that despite the phonetic alignment of boundary tones with the ends of phrases, the tones themselves as lexical items are merged high into the syntactic structure, most likely in the left periphery around C, because their interpretation depends on the presence of an iFrame constituent, which is always part of the last phase

to be Spelled Out. Merging the tones lower in the structure would create a risk of uninterpretability at the IS interface. In order to explain their phonetic alignment in actual utterances, I have suggested that due to their non-segmental nature, their linearization is governed by independent principles of intonational phrasing, which cannot be cyclic with each phase. While this proposal raises many additional questions, it represents a coherent and (at least initially) empirically supported theory, which supports my overall theory of IS and is able to maintain the strong claims of the T-model architecture.

To conclude, there is a final motivation for analyzing boundary tones as lexical items, having to do with their independence from other factors in an utterance. While speakers are somewhat constrained (by considerations of phonological phrasing) in where boundary tones can be placed in an utterance, they are completely unconstrained in their options of which contours to utter, in parallel with the free choice of lexical items, just as long as they fit together grammatically. This parsimonious view of boundary tones gives us a straightforward way to represent informational meaning in a way that has specific phonological consequences, in parallel with selecting a word with a particular denotative meaning that has also has specific (segmental) phonological consequences.

4.4   Nuclear stress and IS

Besides the tonal contour of an utterance, the stress pattern interacts closely with IS. For our purposes, we will be concerned with determining the assignment of primary or "nuclear" stress in utterances. This notion is still mostly an impressionistic one,

corresponding to a perception about which word or words carry the most prominence in an utterance.[42] It is clearly a relative level of prominence, as one can speak very softly and still produce nuclear stress. There is a long and rich history of work that tries to predict the placement of nuclear stress, and it is beyond the scope of the present work to give a comprehensive review of all of it. Instead, I will focus on reviewing the major insights from the literature, especially regarding the different sources of stress assignment, and how stress assignment relates to IS.

4.4.1   Previous approaches to nuclear stress and IS

4.4.1.1   The Nuclear Stress Rule

The first attempt in generative grammar to capture nuclear stress placement in sentences is the Nuclear Stress Rule (NSR) of Chomsky & Halle (1968; henceforth SPE). There are many specifics of the theory in SPE that do not concern us (e.g., the notion of 1 stress, 2 stress, etc.), but the basic intuition is that nuclear stress is predictable, and can be captured with a simple rule, phrased informally as "nuclear stress falls on the rightmost stress-bearing element". This correctly predicts stress in a large number of cases, including the following:

(14)   Schatzi likes CHEESE.

(15)   Schatzi gave some cheese to CORA.

---

[42] Throughout this work, I have used small caps to indicate nuclear stress, and I will continue to do so.

(16)   Schatzi ate the cheese that was sitting under the TABLE.[43]

However, the simple NSR of SPE does not stand up to a great deal of other data,

including sentences with different IS than the above, such as:

(17)   SCHATZI likes cheese. (but John doesn't)

(18)   Schatzi gave some CHEESE to Cora. (not some peanut butter)

(19)   Schatzi ate the cheese that was sitting UNDER the table. (not on top of it)

This NSR also has problems with a different class of data, originally due to Newman

(1946) but used to argue against a simple NSR by Bresnan (1971).

(20)   George has plans to LEAVE.

(21)   George has PLANS to leave.

Finally, the NSR runs into trouble in other languages, particularly head-final languages

like German.

(22)   Ich   habe   ein BUCH   gekauft
        I   have   a book   bought
        'I bought a book.'

---

[43] The longer the utterances get, the more pressure there is to assign more than one strong stress. I assume that this is for phonological reasons of euphony that are independent of the syntactic or informational structure, and I will not consider such patterns here.

Here, the direct object *ein Buch* gets nuclear stress, even though it is not the rightmost element that could get nuclear stress. When there is no direct object, stress can fall on the final verb.

(23)   Das Mädchen habe   GESPIELT
        The girl   has   played
        'The girl was playing.'

Nevertheless, the NSR represents an important viewpoint on the theory of stress placement, which remains today. Namely, that nuclear stress has a default pattern which can be predicted via a simple rule. Many variations on the NSR have been formulated (Bresnan 1971, Schmerling 1976, Culicover & Rochemont 1983, Gussenhoven 1984, Selkirk 1984, Rochemont 1986, Halle & Vergnaud 1987, Cinque 1993, Ladd 1996, Zubizarreta 1998, etc.), but all of them follow this basic idea, that at least in a substantial set of cases, nuclear stress is predictable by a simple algorithm. The most important modification of the NSR in recent times, following Cinque (1993), is to make it much more structure-dependent. This concept is reviewed in the next section.

4.4.1.2   Structural NSR

Cinque (1993) made the important observation that one of the weaknesses of the SPE-style NSR was also a redundancy. That is, the rule was parameterized to be either left-headed or right-headed, in order to try to capture more languages, but Cinque (1993)

noticed that the headedness of the NSR was predictable from the syntactic headedness of the language. In head-initial languages like English, nuclear stress was assigned on the right side, and in (partially) head-final languages like German, it was assigned on the left.[44] Cinque thus offered a "null theory" of stress, whereby stress relations were transparently reflected in the syntax. That is, he assumed something like a metrical tree, and claimed that the metrical tree is isomorphic with the syntactic tree. This was an important step forward, in realizing that nuclear stress is dependent on structure. I will therefore refer to approaches that follow Cinque's general insight as "structural NSR" theories.

An important recent development in structural NSR theories has been to incorporate the notion of phase (Chomsky 1999, 2000; see chapter 3). Slightly different formulations of this connection have been proposed by Legate (2003), Kahnemuyipour (2004), Adger (2006), Sato (2006), Kratzer & Selkirk (2007), and Ishihara (2007), but the basic notion is extremely appealing. Namely, if a phase is a unit sent to PF and LF for interpretation, then it would make sense that phonological rules like the NSR would apply cyclically to phases. This notion is a revival of the intuition behind Bresnan (1971), which claimed that the syntactic cycle and the phonological cycle are synchronized with each other. As will be seen in section 4.2, I adopt this perspective in my theory as well.

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[44] Not *absolute* left, of course, as can be seen in (22), but left within the VP, for example.

4.4.1.3   Nuclear stress and IS

However, as successful as recent versions of the NSR might be, there is still the issue of

how nuclear stress changes with different IS articulations. On the one hand, as

demonstrated famously by Chomsky (1970), some stress patterns are compatible with

several possible information structures. This is demonstrated by the fact that the stress

pattern in (24) can be an appropriate answer for the questions (along with the

corresponding IS partitions) in (25)-(30).

(24)   The police arrested the ex-convict in the red SHIRT.

(25)   Q: Did the police arrest the ex-convict in the red pants?
        A: No, [Fr the police arrested the ex-convict in the red [Co SHIRT]]

(26)   Q: Did the police arrest the ex-convict in the blue pants?
        A: No, [Fr the police arrested the ex-convict in the [Co red SHIRT]]

(27)   Q: Which ex-convict did the police arrest?
        A: [Fr the police arrested the ex-convict [Co in the red SHIRT]]

(28)   Q: Who did the police arrest?
        A: [Fr The police arrested [Co the ex-convict in the red SHIRT]]

(29)   Q: What did the police do?
        A: [Fr The police [Co arrested the ex-convict in the red SHIRT]]

(30)   Q: What happened?
        A: [Fr [Co The police arrested the ex-convict in the red SHIRT]]

For other stress patterns, there is only one IS possible. For example, (31) can only

answer the question and have the representation in (32), not in (25)-(30), or anything else.

(31)   The police ARRESTED the ex-convict in the red shirt.

(32)   Q: What did the police do to the ex-convict in the red shirt?
        A: [Fr The police [Co ARRESTED] the ex-convict in the red shirt]

The generalization, which is readily apparent in the examples throughout this

dissertation, is that nuclear stress must be contained in the iCore (or in other theories, the

Focus, new information, rheme, etc.). However, as the difference between (29) and (32)

shows, nuclear stress cannot appear just anywhere in the iCore. To illustrate more

concretely, the stress pattern in (31) cannot reflect the IS in (33), as demonstrated by the

fact that it is not a felicitous way to respond to the question in (29), repeated below as

(34).

(33)   [Fr The police [Co ARRESTED the ex-convict in the red shirt]]

(34)   What did the police do?

One way to characterize the difference between the IS-ambiguous (24) and the

unambiguous (31) is that the iCore in (24) is able to "project" up the tree from the

stressed element, while it cannot in (31), perhaps in part because the syntactic structure is

entirely right-branching. So the iCore appears to be able to project from the branching

side, but not from the non-branching side, as in (31). This is exactly the pattern that

structural NSR theories such as Cinque (1993) attempt to capture.

    This generalization is further supported by evidence that shows "partial" projection

within a higher position. Consider the following pairs of IS articulations and the

questions they are intended to answer (* is used to indicate illegal combinations of IS and

stress).

(35) Q: Who likes cheese?
      A: [Fr [Co SCHATZI] likes cheese]

(36) Q: What do you know about cheese?
      A: * [Fr [Co SCHATZI likes] cheese]

(37) Q: Whaddya know?
      A: * [Fr [Co SCHATZI likes cheese]]

(38) Q: Does the little black dog that lives at your office like cheese?
      A: No, [Fr the little black dog that lives at my [Co HOUSE] likes cheese]

(39) Q: Which little black dog likes cheese?
      A: [Fr The little black dog [Co that lives at my HOUSE] likes cheese]

(40) Q: Who likes cheese?
      A: [Fr [Co The little black dog that lives at my HOUSE] likes cheese]

The contrast between the pattern of "projection" in (35)-(37) and the pattern in (38)-(40)

is that in the latter, the projection only crawls up the branching side of the tree, as

predicted by most structural NSRs (e.g., Cinque 1993). Thus it appears that some kind of

marriage between IS-related stress assignment and a structural NSR is warranted. The

question now is how exactly that combination will work.

4.4.1.4   IS and NSR working together

The majority of theories recognize the generalization given in the previous section,

though the specifics of how to incorporate both factors varies. The various approaches

can be divided into two general approaches: what I call the IS Adjustment approach and the IS Domain approach.

The IS Adjustment approach represents the more widely implemented account, in which the NSR is thought to operate independently of IS considerations. In these accounts, IS-related stress assignment (through addition and/or deletion of stress) operates totally separately from the NSR, either through some kind of late readjustment rules, or by separate, additional stress assignment (Rooth 1985, Cinque 1993, Truckenbrodt 1995, Zubizarreta 1998, Schwarzschild 1999, Kahnemuyipour 2004, etc.).

The IS Domain Approach, represented independently by Gussenhoven (1984) and Rochemont (1986) claims that IS defines the domain for nuclear stress, and within that domain, something like the NSR determines where exactly the stress falls. In both Gussenhoven (1984) and Rochemont (1986), the domain is simply defined as the node that dominates all and only nodes that are labeled [+focus]. Aside from the use of F-marking, this approach is extremely close to the analysis I develop in the following section. However, this approach is seldom taken elsewhere in the literature, probably in part because of the enduring intuition that IS-assigned stress has a different status than "default" stress. I argue in Chapter 2 that the notion of a "default" IS, while perhaps a valid observation regarding frequent or canonical IS articulations, has no place in the grammatical component of the language faculty. It follows from this that if stress assignment is based on IS domains, which has been clear since (Jackendoff 1972) then there is no conceptual advantage to theories in which IS-related stress should be assigned

by a different mechanism than so-called "default" stress, because default stress is almost certainly a misconception as well.

A final approach that does not quite fall into either camp, but is prominent enough to warrant discussion, is Selkirk's (1984, 1995) notion of Focus Projection (see also Irurtzun 2005, and Büring 2003 for a critique). This takes literally the intuitive idea that I appealed to above regarding the iCore (Focus, for Selkirk) being able to "project" up a tree. This is similar in a way to the IS Domains approach, since it treats IS as the basis for nuclear stress rather than a peripheral, *post hoc* adjustment. Essentially, the theory assumes that words with nuclear stress (for Selkirk, pitch accents) come with a Focus feature. Then, an algorithm is applied that allows the Focus feature to spread onto other nodes.[45] The way this spreading is constrained results in the same general pattern as predicted by structural NSR theories; it is like deriving the NSR from the bottom-up rather than the top-down.

I have not spent a great deal of time detailing the different predictions of all these prior theories of nuclear stress assignment, not because the data are irrelevant, but because in the context of the present study, there is a simpler reason to disprefer them. Namely, they all require some kind of diacritic F-marking in order to capture stress assignment. As I argue in Chapter 2, F-marking is a clear violation of the PF-LF divide, through a violation in the Inclusiveness condition of Chomsky (1995). The ways this feature is applied in these theories of nuclear stress provide good illustrations for my argument.

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[45] When Focus spreads in this system, it only spreads its the semantic/informational interpretation, not its phonological realization.

For example, take the IS Adjustment approach. Essentially, these approaches claim that syntax has an effect on stress assignment through the NSR (or something like it), but also through F-marking. If we defend F-marking by claiming it is a syntactic feature, then it becomes somewhat mysterious why the syntax is redundant in marking stress. Why should there be two independent syntax-prosody interfaces?

Selkirk's (1984, 1995) Focus Projection theory also raises problematic questions. The theory essentially posits a phonological feature in the syntax (for Selkirk the initial F-mark = pitch accent), and then devises a way for it to spread semantic influence through the syntactic tree. This is effectively the same as allowing LF to "see" the location of pitch accents, and derive an interpretation based on that, which is clearly a blurring of the line between PF and LF.

The IS Domain class of theories has the converse problem, where it looks like PF needs to be able to see an LF property. Since the NSR (or its equivalent) only operates on F-marked constituents, the rule needs access to that IS representation. Claiming that F-marks exist in the syntax, and therefore visible to both interfaces, is simply a shell game.

Still, the generalizations remain that on the one hand, nuclear stress is confined within the iCore (thus partially determined by IS), but must fall on a particular syntactic constituent within the configuration of the iCore (thus partially determined by syntactic structure). Is it possible to combine these generalizations into a unified theory, without violating the PF-LF divide, in letter or in spirit? Of course, I argue that the answer is yes,

and that it proceeds logically from the theory devised thus far in Chapters 2 and 3. The following section will detail and defend my proposal.

4.4.2   Phase-cyclic stress assignment in PICH

4.4.2.1   Unified NSR for all stress assignment

Recall the function of phases within the Phase-Information Correspondence Hypothesis (PICH). Phases are syntactic sub-derivations that map cyclically to PF and LF, and under PICH, they correspond to IS units. This effectively allows a phase-based NSR to kill both birds with one stone. As a first pass, I propose the following stress assignment rules:

(41)   Base NSR: assign primary stress to the most embedded XP

(42)   Stress Perpetuation: if a constituent already has primary stress, it keeps it

The formulation in terms of XPs, not just words, follows Truckenbrodt (1995). The result is a clear way to decide among equally-embedded sisters, such as a V and its DP complement. The XP requirement will ensure that stress is placed on the complement.[46] Both rules apply at each Spell Out, thus at each phase. Let us see how this works in

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[46] Alternatively, if we assume that something like X-bar structure must be articulated for every XP (e.g., all NPs contain Ns, even if the NP/N is a single lexical item), then we could formulate the rule to simply place stress on the most embedded terminal node. If we take this stance, then much of the following discussion becomes moot.

practice. For now, let us assume that the only phases are those corresponding to the

iCore and iFrame. Recall the Phase-Partition Mapping Principle from chapter 3:

(43)   *Phase-Partition Mapping Principle* (PPMP) (first try)
        A phase that does not contain an iCore can be mapped to an iCore, and a phase
        that does contain an iCore can be mapped to an iFrame.

Now consider once again this simple sentence:

(44)   Schatzi likes cheese.

In order to illustrate how the stress assignment system works with PICH and the PPMP,

we will go through all eight possible IS articulations. In the first one, *cheese* is selected

out of the lexical array and immediately shipped off as a phase to PF and LF. Recall that

PICH allows phases of arbitrary size; this phase is not required, but it is allowed. Thus,

the first phase is simply:

(45)   DP
                          △
                        cheese

The Base NSR applies, giving *cheese* primary stress. On the LF side, this phase is

mapped to the iCore. Again, it is not required to be mapped to the iCore, but it is

allowed, according to the PPMP. Next, this phase is merged with *likes* to form the VP

likes cheese. Finally *Schatzi* is merged, along with any intervening or supervening

functional heads. The next phase to be spelled out will be the entire sentence.

(46)   [$_{CP}$ [$_{TP}$ Schatzi$_i$ [$_{vP}$ t$_i$ likes$_j$ [$_{VP}$ t$_j$ cheese]]]]

In this case, it does not matter which of the two stress rules apply, because both will end

up with primary stress on *cheese*. This phase must be mapped to the iFrame, because it is

the last available phase, and if the utterance ends up without an iFrame, it will crash at

the C-I interface. It is restricted from being mapped to the iCore because as per the

PPMP, an iCore cannot contain another iCore. The result is the proper mapping between

stress and IS, as given below:

(47)   [$_{Fr}$ Schatzi likes [$_{Co}$ CHEESE]]

For the second example, we will again begin with selecting *cheese*, but this time we will

delay Spell-Out until we merge *likes*, so that the first phase is the VP:

(48)
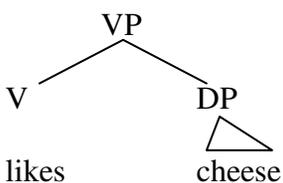
```
              VP
             /  \
            V    DP
           likes cheese
```

The Base NSR rule applies, again assigning primary stress to *cheese*, because it is the lowest XP in the phase. On the LF side, this phase is mapped to the iCore, because it does not contain another iCore. Then *Schatzi* is merged and the whole thing is shipped off as a phase. Either or both stress rules apply, which will again keep the stress on *cheese*. The final product is a VP-focus structure:

(49)   [$_{Fr}$ Schatzi [$_{Co}$ likes CHEESE]]

To finish off the "projection" progression, the next example waits until all constituents have been merged (possibly excluding an invisible event operator, see section 3.3.2) before spelling out the first phase, which is again mapped to the iCore. Since *cheese* is still the most embedded XP, it still ends up with primary stress. An iFrame is still needed, so the sentence is shipped off as a phase again (this time including the event operator). The stress stays on *cheese*, and we have the derivation for an out-of-the-blue I-Structure:

(50)   [$_{Fr}$ [$_{Co}$ Schatzi likes CHEESE]]

Now, things get a bit more interesting. This time, let us select *Schatzi* from the lexical array first, and immediately apply Spell-Out. This means *Schatzi* is the first phase, thus receiving primary stress at PF (because it is the only XP in the phase) and getting mapped to the Core at LF (because it can). Next, we merge *cheese* with *likes*, and then the

resulting VP with *Schatzi* before applying Spell-Out. This time, there is a conflict

between the stress rules. On the one hand, *cheese* is the lowest XP, but on the other hand,

Schatzi already has primary stress. In this case, the Stress Perpetuation rule wins out.

In fact, the Stress Perpetuation rule will *always* win out. The Base NSR rule will

only apply if there is no primary stress already in the derivation. I assume there is some

kind of economy principle behind this, to the effect that creating a stress is more costly

that just leaving things alone. Leaving things alone when there is no primary stress is not

allowed, because a phase at PF without primary stress is an ill-formed object. It is ill-

formed because an utterance without a primary stress is phonologically ill-formed, and

the phonology has no "look ahead" power to know whether the phase it is working on

will be the last in the derivation. Thus, any phase that arrives at PF will get a new stress

assigned, as per the Base NSR rule, and any phase that arrives at PF with a primary stress

already keeps that stress where it is.

Therefore, in the case where *Schatzi* has already been spelled out as the iCore

(and thus already has primary stress), it keeps primary stress when the entire sentence is

spelled out as the iFrame phase. Thus we end up with the correct IS-stress relationship

again:

(51)   [Fr [Co SCHATZI] likes cheese]

For the next derivation, we will do something similar and start with selecting and spelling

out *likes*. This time, we end up with an initial phase that does not contain an XP, because

it is merely a V. But according to the argument above, a phase cannot exist at PF without

a primary stress. Therefore, we will need to modify the Base NSR.

(52)   Base NSR (revised): assign primary stress to the most embedded XP. If there is
        no XP, apply stress to the most embedded head.

This modification allows a stress assignment on the V *likes*. On the LF side, this phase is

mapped to the iCore. The derivation continues by merging in the rest of the sentence,

and spelling it out as the iFrame. As in the previous derivation, the first phase (this time

likes) keeps the primary stress it received when it was spelled out the first time.

However, I have glossed over an aspect of this derivation and the previous one that

deserves close attention – the issue of movement. Consider the present derivation.

(53)
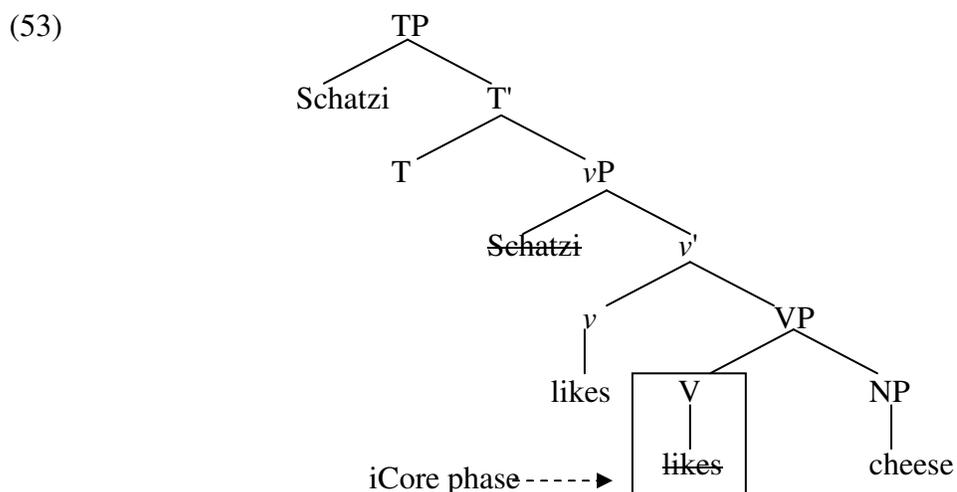
I am assuming a copy theory of movement, in which multiple copies of the same lexical

item are merged in different places, and later (at PF) all copies except one (usually the

highest) are deleted. In the derivation shown in (53), *likes* gets primary stress when it is

spelled out in the iCore phase, which at the time is simply the V. In the subsequent

phase, it moves to the higher *v* position, as is typically assumed. And so there appears to

be a conflict: primary stress was assigned at the V position, not the *v* position, but it is the

V position copy of *likes* that gets deleted at PF.

        In order to preserve stress on *likes* under movement, I propose a method of stress

"inheritance," which will allow stress to be transferred to other copies in a chain. I will

formalize this as the Stress Movement Rule, which is a rule at PF:

(54)   Stress Movement Rule: if a copy to be deleted carries primary stress, transfer
         primary stress to the surviving copy.

Besides being necessary to capture this basic data, this rule is not entirely unmotivated,

especially if we take our earlier assumption seriously, that stress assignment is a costly

operation (which was the proposed rationale for the Stress Perpetuation rule).[47] That is, if

a stress is allowed to be deleted at PF, it may force the need to assign stress again. This

scenario is further complicated by the fact that while stress assignment happens cyclically

at each phase, copy deletion must delay until multiple phases have been spelled out.

Therefore, an independent "repair" stress assignment in the case where the only primary

stress was deleted must be applied post-cyclically, which seems unmotivated. I assume

this is also dispreferred by the system, or even flat disallowed. Considering these issues,

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[47] The costliness of stress assignment may stem from having to evaluate the entire tree for embeddedness.
Simply "passing" a stress between copies (which must be co-indexed anyway) would not require this
additional computation.

stress relocation via the Stress Movement Rule may be a cheaper substitute for stress deletion and re-assignment. Alternatively, it may simply be seen as a PF operation parallel to the copy and deletion function of syntactic move. In any case, we will see additional cases in which this rule plays a crucial role later, in section 4.4.2.2. For now, it helps explain how the current derivation ends up with the proper IS and stress pattern:

(55)   [Fr Schatzi [Co LIKES] cheese]

For the next derivation, let us again begin by selecting *cheese* and immediately applying Spell Out. Just as in the first derivation we considered, it ends up with primary stress on the PF side and maps to the iCore on the LF/IS side. Next, we merge *likes*, but then, before merging *Schatzi*, we Spell Out *Schatzi* by itself. The interfaces treat this phase just as if it were the "first" phase; the Base NSR gives it primary stress, and IS assigns it to the iCore. Or rather, *an* iCore, since *cheese* is already an iCore. There is nothing in our rules prohibiting multiple iCores; it is simply not allowed for iCores to be embedded within each other. Next, when *Schatzi* merges with the *v*P *likes cheese*, there are two iCores and two primary stresses in the same phase. As before, Stress Perpetuation allows any primary stress to remain, resulting in the following:

(56)   [Fr [Co SCHATZI] likes [Co CHEESE]]

This is a perfectly legitimate IS (e.g., as an answer to a pair-list question), and it has the right stress pattern. Note that there is some "flexibility" in how this derivation unfolds. For one, it does not matter whether *cheese* or *Schatzi* gets spelled out "first", nor does it matter whether the VP/*v*P *likes cheese* is merged before or after *Schatzi* is spelled out. All that matters is that both *Schatzi* and *cheese* are spelled out separately before being merged with anything else.

This kind of multiple-iCore derivation can also produce the last four possible IS derivations for this sentence, in the same fashion (given with possible questions that could elicit such IS articulations):

(57)   [$_{Fr}$ [$_{Co}$ SCHATZI] [$_{Co}$ LIKES] cheese]
         Who does what to cheese? (also: What do you know about cheese?)

(58)   [$_{Fr}$ Schatzi [$_{Co}$ LIKES] [$_{Co}$ CHEESE]]
         What does Schatzi think about each food?

(59)   [$_{Fr}$ [$_{Co}$ SCHATZI] [$_{Co}$ LIKES] [$_{Co}$ CHEESE]]
         Who thinks what about which food?

(60)   [$_{Fr}$ [$_{Co}$ SCHATZI] [$_{Co}$ likes CHEESE]]
         Who does what?

Note that there is one bracketing of this sentence that is impossible for this system to derive:

(61)   [$_{Fr}$ [$_{Co}$ Schatzi likes] cheese]

This is not because the phase *Schatzi likes* is entirely ill-formed, but because *cheese* cannot be merged with it without getting "inside" the VP of *likes*. This is prohibited precisely because the inner structure of phases is not available to the syntax after they are spelled out. This is important, because as noted in Chapter 3, the lack of this structure is one of the distinguishing predictions between this theory and the theory of Steedman (2000), which also claims a very close correspondence between syntax and IS. Also as noted in chapter 3 (p. XX), there is empirical evidence that the structure in (61) is impossible, namely that the entire iCore cannot associate with *only* in (52), because it cannot be taken to mean "the only thing I know about cheese is that Schatzi likes it," under any stress pattern.

(62)   Only Schatzi likes cheese.

And so thus far, the stress assignment system as given in (42), (52), and (54), combined with PICH and the PPMP, produces exactly the right results of linking nuclear stress and IS through syntactic structure and the sequence of phase derivations. These rules are all repeated here below.

(63)   *Phase-Information Correspondence Hypothesis* (PICH)
        Phases are freely assigned in the syntax, and are constrained by interface
        requirements. One interface requirement is the need for Information Structure
        partitions. Therefore, phases map directly to the IS partitions of Frame and Core.

(64)   *Phase-Partition Mapping Principle* (PPMP)
        A phase that does not contain a Core can be mapped to a Core, and a phase that
        does contain a Core can be mapped to a Frame.

(65)   Base NSR: assign primary stress to the most embedded XP. If there is no XP, apply stress to the most embedded head.

(66)   Stress Perpetuation: if a constituent already has primary stress, it keeps it

(67)   Stress Movement Rule: if a copy to be deleted carries primary stress, transfer primary stress to the surviving copy.

At this juncture, I should discuss how this system is able to maintain the PF-LF divide where previous theories could not. There are two critical pieces to the picture. First, there is nothing in the narrow syntax that encodes or determines phase structure. Phases are assigned freely, and the interfaces make requirements on the results. No spurious features are introduced into the system in order to dictate the link between PF and LF; it is merely a byproduct of synchronizing the syntactic cycle with the phonological cycle. Second, there is nothing that tells the phonology which phase is an iCore and which is an iFrame. This is what distinguishes this theory from the prior theories that I have termed IS Domain theories (e.g., Gussenhoven 1984, Rochemont 1986). In those theories, the [+focus] feature provides explicit information to the phonology regarding where the relevant IS partitions are. In the present theory, the phonology has no idea what the IS is doing, and vice versa. It is simply a coincidence of the system that the first phase gets primary stress, and is able to get mapped to the iCore. Thus, the system is "double blind," and is able to maintain the strong separation of PF and LF as hypothesized in the T-model architecture.

A second advantage of this theory is that it is able to account for both "default" out-of-the-blue structures like (50), repeated here as (68), as well as so-called "narrow focus" structures like (51), repeated here as (69).

(68)   [$_{Fr}$ [$_{Co}$ Schatzi likes CHEESE]]

(69)   [$_{Fr}$ [$_{Co}$ SCHATZI] likes cheese]

This unified theory combines elements of IS and syntactic structure, all through the mechanism of phases, drawing on the best intuitions of previous theories, while avoiding theoretically problematic elements such as F-marking.

4.4.2.2   Return to the Mapping Hypothesis and Bresnan (1971)

However, not all of our problems are solved yet. I must now make good on a promise I made in section 3.3.3, to integrate the current theory with Diesing's (1992) Mapping Hypothesis. The first problem arises as a result of my proposal from Chapter 3 that the Mapping Hypothesis makes independent demands on phase structure, which results in the VP and TP always being spelled out as phases, regardless of IS. This causes some complications for the sample derivations above. To start with the easiest case, consider the out-of-the-blue IS:

(70)   [$_{Fr}$ [$_{Co}$ Schatzi likes CHEESE]]

In the above walkthrough of the derivation, I claimed that this IS was derived by waiting until the entire sentence (perhaps minus an event operator) was merged together before the first Spell Out. This way, the entire sentence (perhaps minus the event) would get mapped to the iCore. This is not possible if we also assume that the Mapping Hypothesis requires the VP to get spelled out independently for interpretation of the nuclear scope. If we keep this proposal from Chapter 3, then the resulting phase layering is as given below:

(71)   [phase3 [phase2 Schatzi [phase1 likes CHEESE]]]

Phase 1 and Phase 2 are required by the Mapping Hypothesis, and Phase 2 and Phase 3 are required by PICH. However, this is actually not a problem at all, due to the "optional" nature of the PPMP, repeated here.

(72)   *Phase-Partition Mapping Principle* (PPMP)
        A phase that does not contain an iCore can be mapped to an iCore, and a phase that does contain an iCore can be mapped to an iFrame.

The critical "can" wording allows for a phase to be sent to PF and LF without being designated as either iFrame or iCore. This means that IS can "pick and choose" which phase to interpret as the iCore and which to interpret as the iFrame, just as long as 1) there is one of each in each utterance, 2) no iCore contains another iCore, and 3) every iFrame contains an iCore. The fact that the PPMP is phrased in terms of these interface constraints is one factor that allows it to preserve the PF-LF divide, because these constraints remain "invisible" and irrelevant to PF.

However, this "pick and choose" quality creates a different problem, when paired with the assumption that phases are freely assigned and filtered by the interfaces rather than required. Namely, it predicts that the out-of-the-blue all-iCore IS should be possible with the following phase layering, in which *Schatzi* is spelled out as its own phase before merging with the vP:

(73) [$_{phase3}$ [$_{phase2}$ Schatzi] [$_{phase1}$ likes CHEESE]]

Essentially, the problem is how to prevent stress from ending up on *Schatzi*, since it gets spelled out as its own independent phase before it is merged and spelled out with the entire iCore.[48] In larger structures, this problem generalizes, allowing rampant phasing (and thus stressing) of left branches that should not receive stress.

So we appear stuck between making the iCore mapping liberal enough for it to be larger than the VP (the phase required by the Mapping Hypothesis), and making it strict enough to rule out an arbitrary number of phases in places that should not receive stress. The key is in the generalization that as long as the phases within the iCore are nested and right-branching (as in (71)), stress ends up in the right place (on only the most embedded XP). Therefore, I propose a further interface constraint on the iCore.

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[48] In this particular case, it may not be entirely problematic to keep stress on Schatzi, to the extent that (i) appears to be an okay stress pattern for an OOTB utterance:
      (i)   SCHATZI likes CHEESE.
However, I assume that given an OOTB context in a larger structure, it is not preferable to allow arbitrary stressing of left branches, which will make the current solution necessary.
      (ii)   * [$_{Fr}$ [$_{Co}$ The POLICE ARRESTED the ex-convict WITH the red SHIRT]]

(74)   The Core Construction Constraint (CCC): within the iCore, the nesting of phases must be "hierarchy preserving." They must preserve the nesting of phrase structure, and no phase may c-command another phase.

The conditions of the CCC conspire to enforce all iCores to consist of phases that are all nested on the branching side of the structure (the right branches in English). The restriction on c-command rules out the problematic phasing in (73). The restriction on "preserving phrase structure nesting" prevents phrase structures like (75) getting mapped to IS partitions in (76) via phases in (77).

(75)   [$_{TP}$ [$_{DP}$ The dog [$_{PP}$ with [$_{DP}$ the black fur]]] [$_{vP}$ likes [$_{VP}$ [$_{DP}$ CHEESE]]]]].

(76)   [$_{Fr}$ [$_{Co}$ The dog with the black fur likes CHEESE]].

(77)   [$_{phase3}$ [$_{phase2}$ The dog with the [$_{phase1}$ black] fur likes CHEESE]].

The phase articulation in (77) would incorrectly put an additional stress on *black*. It is ruled out by the CCC because the nesting in (77) does not preserve the hierarchy of the phrase structure in (75).

The CCC has the flavor of a *post hoc* addition in order to iron out one of the kinks of the system. However, there may be some reasons to suspect that it has a deeper independent motivation. The function of the CCC is to make the iCore uniform in a particular way. Everything branches in the same direction, including the phrases, and there is no ambiguity about the chain of dominance. Given that the iCore signals a single denotational contribution to the discourse, this kind of extreme uniformity may be an

asset. In more functional terms, by militating against structures that would give rise to more than one primary stress within a single iCore, the stress is allowed to be an unambiguous signal for the "edge" of the iCore. Clearly nuclear stress does not disambiguate the iCore in all cases (recall the ex-convict in the red shirt), but it does always mark the edge of the iCore,[49] which may be an important perceptual cue to identifying the iCore, which would be lost if the system allowed multiple stresses per iCore.

In any case, I will leave the question of whether the CCC is formally motivated, functionally motivated, or unmotivated and ill-formed, open for further research. For our current purposes, it is enough to note that it is critical for the proper functioning of the system, especially if we allow multiple phases under a single iCore, as the Mapping Hypothesis would seem to require.

Moving onward, we are now ready to tackle some interesting data regarding the Mapping Hypothesis more directly. Recall the following ambiguous sentence from Diesing (1992).

(78)   Firemen are available.

On the existential reading of *firemen*, the sentence is equivalent to "there are firemen available". On the generic reading of *firemen*, the sentence is equivalent to "a general

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[49] Of course, this does not exactly hold in languages where headedness is mixed, such as German. Still, assuming the system is aware of the headedness of each phrase, the stress will still mark the "edge" in a more abstract sense.

quality of firemen is that they are available". But although this sentence is ambiguous, it can be somewhat disambiguated prosodically. Diesing (1992) notes that (79) appears to disambiguate for the existential reading, while (80) appears to disambiguate for the generic reading.

(79)   FIREMEN are available.

(80)   Firemen are AVAILABLE.

However, Zwart (1995) points out that under contrastive focus (i.e., a narrow iCore in a contrastive discourse context), the judgments reverse directions. In fact, it is more accurate to note that under contrastive focus, the sentences are actually ambiguous. In short, a narrow iCore on either *firemen* or *available* makes both utterances ambiguous, but an all-Core IS (i.e., OOTB context) disambiguates the two. Consider the following.

(81)   A: I've heard that policemen are generally available.
        B: No, not policemen! [Fr [Co FIREMEN] are available.]

(82)   A: I feel pretty safe here, because I know that there are a lot of policemen available to help.
        B: No, not policemen! [Fr [Co FIREMEN] are available.]

(83)   A: Firemen are generally never around when you need them.
        B: That's nonsense! [Fr Firemen are [Co AVAILABLE].]

(84)   A: Oh no, we have a fire in the house! It's too bad there aren't any firemen around!
        B: What are you talking about? [Fr Firemen are [Co AVAILABLE].] Just call them.

(85)   A: What if something goes wrong?
        B: Don't worry! [Fr [Co FIREMEN are available.]] You can just call them.

(86)   A: Well, I know chefs tend to be pretty surly. What about other professions?
        B: ?? Well, [Fr [Co FIREMEN are available.]]

(87)   A: What if something goes wrong?
        B: ?? Don't worry! [Fr [Co Firemen are AVAILABLE.]] You can just call them.

(88)   A: Well, I know chefs tend to be pretty surly. What about other professions?
        B: Well, [Fr [Co firemen are AVAILABLE.]]

As shown in (81)-(84), a narrow, contrastive reading of either *firemen* or *available*

renders both the existential and generic readings acceptable. In contrast, (85)-(88)

demonstrate that when the entire clause is in the iCore (i.e., new information), only the

existential reading is available when stress falls on *firemen*, and only the generic reading

is available when stress falls on *available*.

Zwart (1995) claims that these data[50] can be explained in a copy theory of

movement, where stress is a signal for which copy to interpret. That is, following

Diesing (1992), he assumes that an indefinite DP is interpreted as existential within the

VP, but as generic outside the VP (i.e., in the specifier of the TP). He then proposes a

Prosodic Mapping Hypothesis which states that an indefinite with nuclear stress gets

interpreted at its lower copy (inside the VP), while an indefinite without get interpreted at

its higher copy. This is a very interesting generalization, which we will see carries over

to other data, but it has two problems as a theory. First, this analysis does not stack up

well with the contrastive focus cases. Zwart (1995) appeals to Selkirk's (1984, 1995)

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[50] Zwart (1995) did not notice the ambiguity of the contrastive focus cases.

Focus Projection theory and tries to claim that since the Focus in the "all focus" cases

projects while the Focus in the contrastive focus does not, that these structures have

different prosodic properties, which excuses the Prosodic Mapping Hypothesis from

interacting with the latter. This does not quite follow, since the two types of focus do not

(necessarily) have any prosodic differences whatsoever, [51] and it is unclear what principle

should apply to the contrastive cases instead. This analysis has conceptual problems, too,

in terms of the present study, because the Prosodic Mapping Hypothesis is a rather

blatant connection between PF and LF, since it specifically requires the interpretive

system to access a phonological representation.

In contrast, these complex data find a rather straightforward analysis in the theory

I have developed thus far. First, let us consider the derivations of the ambiguous cases, in

which *firemen* is the only thing in the Core. According to Diesing's (1992) Mapping

Hypothesis, an indefinite interpreted in VP gets an existential reading, while an indefinite

interpreted in TP (her IP) gets a generic reading. I will assume that readings are fixed

when the indefinite first gets Spelled Out and sent to LF. I further assume that there are

two options for the base generation of *firemen*: within the VP, as a complement of the

predicate *available*, or in [Spec, *v*P].

In the narrow focus cases, *fireman* will be Spelled Out as its own phase, and will

therefore get immediately interpreted, wherever it is base generated. In other words, it is

able to get either reading. In the following phases, *firemen* moves up to its surface

position at [Spec, TP], but it keeps the interpretation it started with in both derivations,

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[51] And besides, the projected Focus (as opposed to the base generated Focus) in Selkirk's theory has no
effect on prosodic structure, but only interpretation structure.

since it has already gone to LF. Conversely, when *available* is in narrow focus, it gets its own phase and gets nuclear stress. From then on out, no matter where *firemen* is merged and interpreted, the stress will stay on *available*.

In the case of the all-iCore IS with stress on *available*, the first phase must be the VP, as militated by the Mapping Hypothesis. Because the Base NSR assigns stress to the lowest XP, the only way for *available* to end up with stress is if it is by itself in the VP, which would mean that *firemen* is base generated in the *v*P, and thus can only get a generic interpretation. In the case of the all-iCore IS with stress on *firemen*, the opposite is the case. That is, since the first phase must be the VP, and since *firemen* ends up with stress, it must be within the VP during the first phase, thus getting an existential interpretation. When it moves up to [Spec, TP], the primary stress goes with it, as required by the Stress Movement Rule, which was formulated above for independent reasons.

Thus the full pattern of data in (81)-(88) is accounted for, falling out naturally from the theory developed thus far. This same pattern of explanation also provides an account for the data from Halliday (1970) that was mentioned in chapter 2 but put off until now. Recall the situation described by Halliday, where a character sees the following sign in the London underground, and panics because he does not have a dog with him.

(89)   Dogs must be carried.

The preferred reading can be paraphrased "in general, dogs must have the property of being carried", while the hapless character got the other reading, paraphrased "there must be a dog that one carries". Exactly parallel to the *firemen* examples, narrow focus on *dogs* or *carried* induces ambiguous readings, while an all-iCore IS with stress on *dogs* induces the misunderstood, humorous existential reading, and an all-iCore IS with stress on *carried* induces the preferred generic reading. Partee (1991) framed this example of IS interacting with truth conditions to be an issue with modals, but in fact, my analysis suggests that the indefinite is the source of the variation in readings. Simply changing *dogs* to a definite DP like *the dog* removes the ambiguity entirely.

Finally, this same pattern whereby stress in an all-iCore IS is a sign of origination from a lower position also applies to the data first investigated by Newman (1946) but more famously raised by Bresnan (1971).

(90) George has PLANS to leave.

(91) George has plans to LEAVE.

Again, these data have seemed fragile at times (cf. Berman & Szamosi 1972, Bolinger 1972) because of the influence of narrow focus, which serves to make both patterns ambiguous. This is demonstrated in the following, which parallels examples (81)-(88):

(92) A: I think George is leaving now.
B: No, [Fr George has [Co PLANS] to leave], but I doubt he will.

(93)   A: I think George is going to leave a model here.
       B: No, [Fr George has [Co PLANS] to leave]; he didn't finish the model.

(94)   A: I think George has plans to stay.
       B: No, [Fr George has plans to [Co LEAVE]]

(95)   A: I think George has some plans to take with him.
       B: No, [Fr George has plans to [Co LEAVE]], not take with him.

(96)   A: What will we do here without any direction?
       B: Don't worry! [Fr [Co George has PLANS to leave.]] We can use those to
       figure out what to do.

(97)   A: Are you coming?
       B: ?? Well, I can't go anywhere until [Fr [Co George has PLANS to leave]]. He's
       my ride.

(98)   A: What will we do here without any direction?
       B: ?? Don't worry! [Fr [Co George has plans to LEAVE.]] We can use those to
       figure out what to do.

(99)   A: Are you coming?
       B: Well, I can't go anywhere until [Fr [Co George has plans to LEAVE]]. He's my
       ride.

Note that (97) seems relatively acceptable, though certainly less so in contrast with (99).

However, this is probably due to the relative ease in constructing a contrastive discourse

situation compared to the difficulty of constructing a discourse context where a

contrastive reading is not available. It seems clear that any reading in which (97) means

"George wants to leave" is contrastive with *plans*, confirming the overall pattern.

       The analysis proceeds exactly as for the indefinite *firemen* data, where stress is an

unambiguous sign of originating lowest in the structure only in the all-Core cases, and

where the narrow focus cases are allowed to be ambiguous because they are spelled out

and stressed early in their respective positions, overriding the opportunity for disambiguating stress to apply.

Thus, three classic, recalcitrant, and apparently disparate data sets find a unified, straightforward analysis in the current theory, based on a set of simple rules that are motivated for completely independent reasons. Furthermore, the analysis supports the intuitions of the researchers that have worked on the data, by supporting the Mapping Hypothesis on the one hand, and the intuition that (92)-(99) are a result of synchronization between the syntactic and phonological cycles on the other.

It is also worthy of note that many researchers have long been intrigued by the apparent parallel of information structure with the kind of tripartite semantic structures that are captured in Diesing's (1992) Mapping Hypothesis (see especially Hajičová, Partee, & Sgall 1998). Indeed, it often appears that one could simply substitute the Core (a.k.a. Focus) for the nuclear scope and the Frame (a.k.a. Topic) for the restrictive clause, but the correspondence does not seem to be complete. In the words of Partee (1991), "syntax wins". The present theory offers an explanation for this apparent correspondence. Both the Mapping Hypothesis (which does deal with tripartite structures) and Information Structure depend on the same mechanism – the derivational phase – in their articulation. In natural language, where frequent patterns tend towards uniformity and isomorphy, we might expect that there is some pressure to simplify the phase articulation of a sentence, thus aligning these two different aspects of interpretation. It is not clear whether the pressure comes from a tendency towards computational simplicity, or whether it stems from more immediately functional

pressures such as processing load, but it is not terribly surprising that such a pressure might exist. I must leave the rest of this puzzle to future research, but nevertheless, the current theory appears to shed light on what was previously a deep mystery, which is now reduced to a mere puzzle.

4.5   Conclusions

Another mystery that this theory offers a possible explanation for is the apparently deep and cross-linguistically ubiquitous connection between stress and information. While previous speculation has always settled on a functional explanation like "information should be prominent", the present theory offers a potential formal explanation: stress and information are connected by accident, as a byproduct of the independently motivated phase mechanism, which synchronizes the syntactic and phonological cycles. This of course does not rule out the functional explanation, and it appears to be somewhat dependent on functional notions itself (cf. the motivation for the CCC). However, this perspective opens up new avenues of formal inquiry into a topic that has always been shrouded in mysterious and vague functional accounts.

But most concretely, the present theory provides a simple way to derive stress patterns from the mechanism that drives IS partitioning, in a way that does not violate the strict T-model division between PF and LF. Many issues and details remain, but at least for now, the path is relatively clear.

CHAPTER 5

CONCLUSIONS

5.1   Summary of the proposal

The proposal defended in this dissertation is multi-faceted, including a theory of how

Information Structure (IS) interacts with the semantic component (chapter 2), how IS is

represented in the syntax via the mechanism of cyclic Spell-Out (chapter 3), and how this

representation gives rise to a natural link between phonological stress and informational

status (chapter 4). In terms of the general grammatical architecture I am trying to defend,

this state of affairs is represented graphically in Figure 5-1.

Figure 5-1: Modules of the theory
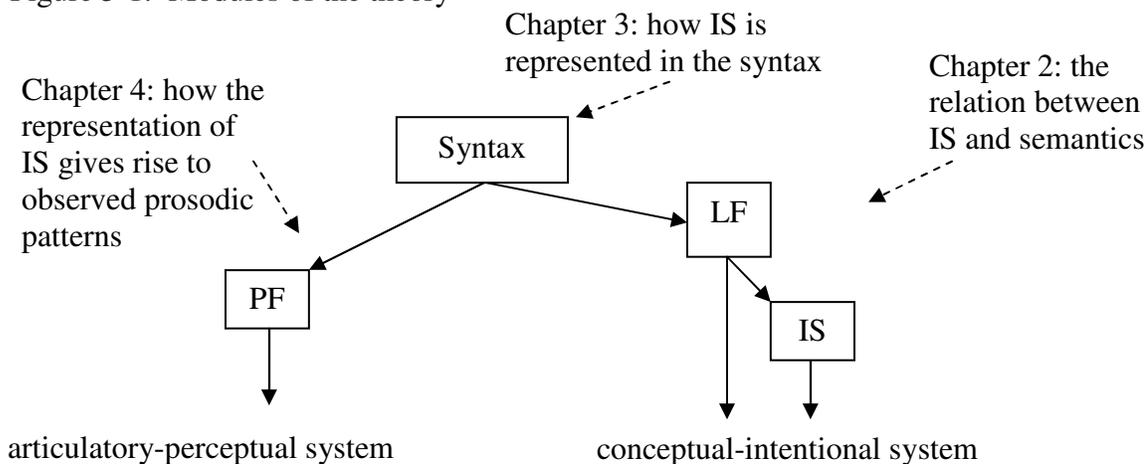
While these facets have been presented as components of a unified theory, there is a

degree of independence between them. This section aims to review the various sub-

proposals, and discuss to what extent they depend on each other.

5.2   The IS-semantics interface

The first facet of the theory is the interface between IS and semantic structure, as

presented in Chapter 2. In particular, this part of the theory describes how semantic

structures are divided into the informational partitions of the iCore and iFrame, how these

semantic sub-units of a sentence are manipulated in order to present different

informational foci, and how these informational effects can have apparent effects on the

truth conditions of some sentences.

The overall couching of the theory follows the insights of Chafe (1976) and

Vallduví (1992) that IS represents a packaging of semantic units. To this end, I have

proposed the partitioning of utterances into Information Cores (iCores) and Information

Frames (iFrames). Loosely speaking, the iCore contains the "new" information, or the

contribution to the discourse, while the iFrame contains the "old" information, or the link

to the background or current state of the discourse. Semantically, the iCore is the

denotative value of some syntactic constituent, and the iFrame is a semantic abstraction

with a variable, such that the substitution of the value of the iCore for that variable results

in the proposition of the sentence. Consider the simple examples in (1) and (2).

(1)   [$_{Fr}$ Schatzi likes [$_{Co}$ CHEESE]]

      a. iCore: *cheese´*   (= the denotation of "cheese")

      b. iFrame: λx. *likes´*(*Schatzi´* x)   (= things that Schatzi likes)

(2)   [$_{Fr}$ [$_{Co}$ SCHATZI] likes cheese]

      a. iCore: *Schatzi´*   (= the denotation/referent of "Schatzi")

b. iFrame: λx. *likes´*(x *cheese´*)   (= people/things that like cheese)

In a typical discourse situation, (1) would be uttered when the topic of discussion was things that Schatzi likes, and the speaker wished to contribute the assertion that cheese is one of those things. Similarly, (2) would be uttered when people (or dogs, or animals, or some other discourse-constrained set) that like cheese was the topic of discourse, and the speaker wished to contribute that Schatzi was a member of the set of cheese-likers.

This theory departs from more standard theories of IS representation (e.g., Jackendoff 1972, Selkirk 1984, Rooth 1985, Vallduví 1992, Büring 1997a) in at least two ways. First, in most theories of IS, the IS bracketing or annotation (e.g. F-marking) has a relatively static, fixed interpretation. Elements marked with Focus (or rheme or comment, etc.) are interpreted one way, and elements marked as Topic (or theme or background, etc.) are interpreted another way. In contrast, I have proposed the PII hypothesis, repeated here in (3):

(3)   *Partition-Instruction Independence* (PII): Information Structure is composed of two primitives – partitions and instructions. The partitions provide semantic abstractions and alternative sets, and the instructions act as suggestions to the listener on how to operate on these semantic units in order to integrate the information of the utterance.

According to this hypothesis, the articulation of an utterance into informational units (my iFrame and iCore) is somewhat independent of how those units are interpreted. In other

words, the articulation into iFrame and iCore provides the constituents of IS, and the

instructions provide the informational interpretations assigned to those units.

In my system, the instructions are instantiated as two operations, LINK and EDIT.

The LINK operation is conceived as a suggestion for the listener to retrieve or activate

some concept in the active discourse representation. This provides the connection to the

existing discourse and/or knowledge states of the participants. The EDIT operation is a

suggestion to the listener in how they should modify their discourse/knowledge

representation. The "default" values for LINK and EDIT are given below:

(4)   LINK = retrieve the iFrame from K_H (the Listener's knowledge)

(5)   EDIT = add the iCore to the list of entities that evaluate true when combined with
        the iFrame[52]

I hypothesize that the primary determiners of LINK are the boundary tones that are found

in the phrase containing the iFrame and iCore. Under this conception, the "default"

values given above are not actually default, but rather provided (in English) by the L-L%

tonal contour, which is the typical declarative falling contour. I analyze the L-H%

contour – sometimes called a "continuation rise" – as providing the following LINK

instructions:

(6)   LINK = retrieve the iFrame´, where the iFrame´ = the iFrame, with ¬∃ substituted
        for the λ-operator.

---

[52] As mentioned previously, I have not attempted a thorough analysis of the IS of questions. The "evaluates
true" condition may need to be modified to accommodate such an analysis in the future.

The EDIT operation is the same as with L-L%, noting that it operates on the normal iFrame, not the iFrame´. The difference from the L-L% meaning is in the LINK operation. I argue in Chapter 2 that this difference provides a unified analysis for several apparently disparate phenomena, such as the "contradiction contour", echo questions, and apparent scope-inversion effects with negation. These are exemplified below, respectively.

(7)   A: No one I know actually likes cheese.

      B: That's not true. **SCHATZI likes cheese**
                    H*   **L-H%**

(8)   A: You know what I heard the other day? Schatzi likes cheese!

      B: What? **SCHATZI likes cheese**   Are you serious?
                  H*   **L-H%**

(9)   EVERY home wasn't wiretapped   (but some of them definitely were.)
      H*   L-H%

I also depart from standard analyses of *only* and association with focus (e.g., Rooth 1985, 1992) by claiming that the meaning of *only* is to alter the EDIT instructions thus:

(10)   EDIT: $(\lambda x . \textit{likes}´\textit{cheese}´x)(x) = 1 \rightarrow x = \textit{Schatzi}´$ "if there is an *x* that likes cheese, that *x* is Schatzi"

This analysis puts *only* on par with other discourse-related particles like German *doch*. It also raises the general possibility that other lexical items other than intonational boundary tones can act to alter informational instructions. Given that I analyze boundary tones as lexical items themselves, this is an expected result.

This approach has some conceptual and empirical appeal, but it is not strictly necessary in order for the other elements of the theory presented here to apply. That is, the rest of the theory could assume more standard notions of how the meaning of IS categories is determined, and could even accommodate more traditional Roothian analyses of words like *only*. Nevertheless, I suggest that the historical difficulty of pinning down exactly how IS categories should be interpreted is because they are not static, and so looking for a static, constant meaning for the informational iCore is a doomed pursuit. The PII hypothesis provides a way to handle this variability in a principled way.

However, I should mention that the PII hypothesis as given here may be an overstatement of the independence of partitions and instructions. For example, in all of my analyses, the LINK instruction deals with the iFrame, and EDIT deals with the iCore. It is possible that this is always the case, fixed by some other principle. If this is true, it places a very large constraint on how independent the partitions and instructions really are.

Even so, even if LINK always operates on iFrames, and EDIT always operates on iCores, there is still a degree of independence. Namely, while elements like intonational contour may change the instructions – how exactly the informational units are to be

related to the discourse – the units themselves do not need to change. That is, we do not

need more labels for the constituents of IS than the simple iCore/iFrame distinction.

Notions that in other theories are analyzed with a proliferation of labels for the units (e.g.,

Steedman's rheme-theme vs. background-focus, Büring's Contrastive Topic) can be

captured by simply modifying the instructions that relate the iCores and iFrames to the

discourse, without having to come up with additional constituent types beyond iCore and

iFrame.

The second key aspect of the theory of IS partitions developed here has more of a

domino effect on other parts of the theory. Namely, I assume – *contra* virtually all

preceding work on IS articulations – that the IS categories of iFrame and iCore are *nested*

structures. The very definitions of the units depend on this notion. An iCore must

always be contained within an iFrame, and an iFrame must always contain at least one

iCore. The advantage of this kind of structure to the semantic component is that a

relatively straightforward operation of variable-substitution for the iCore provides the

denotation of the iFrame. This is particularly useful in cases where the iFrame appears

discontinuous.

(11)   [$_{Fr}$ Schatzi [$_{Co}$ ATE] the cheese]
                    H*   L-L%

    a.   iCore = *ate*´   (= the denotation of "ate")

    b.   iFrame: λx. x (*Schatzi*´ *cheese*´)   (= the relation between Schatzi and cheese))

This appears to be the correct analysis, in that the Frame is unitary, not a conjunction of two separate units ("Schatzi" and "cheese"). In other non-nested theories, the elements outside of the iCore (or "focus" in those theories) must either be discontinuous, or separate constituents altogether (e.g., Vallduví's *link* and *tail*). In my theory, the nested structure provides a straightforward way to allow these apparently discontinuous iFrames to be continuous.

But the real crux of this representation comes in the syntactic analysis of Chapter 3. If IS categories are to be derived using the mechanism of phase – multiple Spell-Out – then this nested structure is expected, since phases themselves are nested. This allows a fairly straightforward mapping from phase structure to IS partition structure. If the nested aspect of IS categories was taken away, this mapping would become much more complicated, and might become untenable. Therefore, the syntactic facet of the theory depends much more on the nested IS structure than it does the PII hypothesis.

5.3   The IS-syntax interface

Moving on to the syntactic component, I have already mentioned the central hypothesis, and I will repeat it here.

(12)   *Phase-Information Correspondence Hypothesis* (PICH)
Phases are freely assigned in the syntax, and are constrained by interface requirements. One interface requirement is the need for Information Structure partitions. Therefore, phases map directly to the IS partitions of iFrame and iCore.

PICH is at once a radical and extremely conservative reworking of the phase theory of Chomsky (2000, 2001). It is radical because it represents a fundamental change in how phases are identified in the system. But from another perspective it is very conservative, in that it is arguably a more Minimalist formulation of phases than Chomsky's original hypothesis that phases are driven solely by CP and vP, categories with "complete propositional structure" (i.e., full argument structure).

One way to view Chomsky's original proposal is that it is an interface requirement. That is, instead of the syntax taking a C or v head as some kind of "cue" to begin a phase, only certain phases are convergent at the C-I interface, and perhaps the need to be "propositional" represents a kind of interface constraint. From this point, it is a small step to hypothesize that because the C-I interface is quite complex (minimally responsible for both denotative and informational interpretation), it is natural to expect more than one interface requirement on the size of phases. My proposal is simply that IS provides *one* of the interface requirements, not the *only* one. The result is that (some) phases can be mapped to IS categories.

This aspect of the theory is critical in terms of the larger architectural issues. That is, I argue that it provides a way for the relation between stress and IS categories to be mediated in the syntax without violating the letter or spirit of the PF-LF divide. This is based on my argument that virtually any kind of "F-marking" method of labeling syntactic nodes with IS features constitutes a strong rejection of PF-LF independence. If this argument ultimately fails, however, and F-marking is much more innocuous than I have suggested, then the phase-based assignment of IS categories becomes less critical.

All one would need is a system that provides a nested structure of iFrames and iCores as needed by the interpretational component.

In empirical support of my phase-based hypothesis, it appears to offer several interesting analyses that are unavailable to F-marking or even movement-based theories of IS (e.g., Rizzi 1997). The critical analysis is the parallel treatment of the interpretation of indefinites as noticed by Diesing (1992) and Zwart (1995) along with the classic data from Bresnan (1971) that she used to argue for synchronization of the syntactic and phonological cycles. Samples of this data are given below.

(13)   [$_{Fr}$ [$_{Co}$ FIREMEN are available]] = required existential reading of *firemen*

(14)   [$_{Fr}$ [$_{Co}$ FIREMEN] are available] = ambiguous between existential and generic readings of *firemen*

(15)   [$_{Fr}$ [$_{Co}$ Firemen are AVAILABLE]] = required generic reading of *firemen*

(16)   [$_{Fr}$ Firemen are [$_{Co}$ AVAILABLE]] = ambiguous

(17)   [$_{Fr}$ [$_{Co}$ George has PLANS to leave]] = must mean that George is leaving some plans.

(18)   [$_{Fr}$ George has [$_{Co}$ PLANS] to leave] = ambiguous

(19)   [$_{Fr}$ [$_{Co}$ George has plans to LEAVE]] = must mean that George is planning to leave.

(20)   [$_{Fr}$ George has plans to [$_{Co}$ LEAVE]] = ambiguous

The general pattern here is that when the structure is entirely in the iCore, the stressed constituent is interpreted as if it were lowest in the structure (i.e., within the lowest VP),

but when the stressed element is the only thing in the iCore (i.e., narrow focus), the sentences are ambiguous.

This striking pattern of data finds a natural explanation in the phase-based theory, as argued in Chapters 3 and 4, essentially because the phase structure affects where a constituent is interpreted in the structure, as well as how stress is assigned. This fits in perfectly with the idea that phases are partially related to IS as well. While others (e.g., Legate 2003, Adger 2006) have proposed similar accounts for some of the data – specifically the all-iCore sentences – that adhere more closely to Chomsky's original formulation of phases, dealing with the interaction with IS is problematic for these analyses, and appears to undercut the importance of the basic insight that phases are an important determinant of sentential stress patterns. By integrating IS into the phase system, my theory is able to provide a unified analysis for both the "default" patterns as well as the "narrow focus" patterns.

In summary, while the phase-based proposal of PICH is not strictly necessary to derive the IS partitions and their semantic effects as developed in chapter 2, it provides a very straightforward way to provide the needed iFrames and iCores, it suggests a simple conceptual extension of Chomsky's original (2000, 2001) proposal, and it provides an elegant and unified analysis of some recalcitrant data involving the interaction of interpretation, structure, and sentential stress. Furthermore, because I argue that IS provides only *one* of potentially many interface requirements on phases, this proposal does not appear to entail massive revisions of previous work that has made use of the more traditional formulations of phase theory. I argue specifically that if we assume that

Diesing's (1992) Mapping Hypothesis requires phases at TP and VP (corresponding to Chomsky's CP and *v*P phases), then my proposal does little or no damage to previous work following Chomsky's original (2000, 2001) proposal.

5.4   The IS-phonology interface

Finally, there is a component of the theory that details how phase structure maps to the phonological determination of nuclear stress. The idea is rather simple, that stress rules will apply at each phase cyclically. I propose a base Nuclear Stress Rule, and two derivational rules:

(21)   *Base NSR*: assign primary stress to the most embedded XP. If there is no XP, apply stress to the most embedded head.

(22)   *Stress Perpetuation*: if a constituent already has primary stress, it keeps it.

(23)   *Stress Movement Rule*: if a copy to be deleted carries primary stress, transfer primary stress to the surviving copy.

The precise formulation of these rules, particularly the Base NSR, is based on previous work (especially Truckenbrodt 1995, 1999), but they are still somewhat up for grabs. That is, no element of the overall theory I have developed hangs on the exact formulation of these rules. What I aim to capture is simply the idea that there is something like a structural NSR (cf. Cinque 1993) operating in a phase-based cycle. In "default" cases of all-iCore IS (i.e., out-of-the-blue utterances), this will line up with more traditional formulations of NSRs (e.g., Chomsky & Halle 1968, Selkirk 1984, Halle & Vergnaud 1987, Cinque 1993).

In cases where the iCore is "narrow," the rules will operate to provide stress in the correct place where other systems require special Focus-assignment or readjustment rules, because the iCore will always be the most deeply embedded (and therefore most stressed) phase. In other words, in my theory, so-called Focus stress is derived from exactly the same mechanisms as so-called "default" stress. This critically depends on PICH, and so if the phase-based IS is removed from the syntactic component of the theory, then the phonological component is lost as well.

I take the generality of the stress rules to be a major advantage to the overall theory, and a good argument for the utility of PICH. However, some might object to collapsing so-called Focus stress with "default" stress. One might object that there is some phonological or phonetic difference between the stress assigned in contrastive or "narrow Focus" cases and the stress assigned in non-contrastive utterances with merely new information. Assuming that this is empirically true (which is not entirely clear), I suggest that the difference is not one that has to do with nuclear stress assignment, but rather represents the use of phonetic cues in an affective, extra-grammatical way.

For example, one prosodic factor that speakers can vary is their overall pitch range within an utterance. This variation is commonly analyzed as varying with speaker attitude and affective state, rather than interacting with grammatical properties of the utterance. I believe that if speakers produce a more pronounced peak for "contrastive Focus" than for "default" information focus, it represents the same kind of distinction as other changes in pitch range, namely an affective, extra-grammatical one. An alternative but similar explanation would be that the heightened prosodic emphasis for contrastive or

"narrow" focus would be that it typically represents stress falling in a non-canonical position (e.g., not sentence final in English). So it ends up with heightened prosodic emphasis merely for the fact that it falls in a non-canonical, and therefore prosodically marked position.

Neither of these possibilities requires that there be a true grammatical or informational difference, at least not in the strict sense of Information Structure as what I have addressed in this thesis. That is, in the theory I have developed here, contrastive and "default" focus both receive essentially the same IS analysis. They both represent a contribution of novel material (from the iCore) in reference to a background assertion, individual, or property (from the iFrame). The difference is merely that in a contrastive case, the iCore is being contrasted with a set of alternatives, which may be explicit or implicit in the discourse. In other words, there is more focus (no pun intended) given to the alternatives, whereas the alternatives are less of an issue in the non-contrastive case. This distinction is not represented in the LINK or EDIT instructions, but rather in the kinds of pragmatic inferences made by the listener. Consider the following sentence, in which the subject receives an emphatic level of stress:

(24)   SCHATZI likes cheese
        L+H*   L-L%

This sentence may or may not be perceived as contrastive, depending on the discourse context. If it is preceded by the question, "who here likes cheese?", it comes across as simply an enthusiastic or emphatic response, and does not strongly imply that Schatzi is

being compared with any alternatives. However, if it is preceded by an assertion by a different speaker that Cora likes cheese, then this sentence does give a strong implication that Schatzi likes cheese, but Cora does not. I suggest that the perception of contrastiveness in such an example comes about by pragmatic reasoning, not by an explicitly encoded informational difference. That is, the listener attempts to project a reason for *why* the speaker is contributing the information that Schatzi is a member of the set of cheese-likers, and if it is following a sentence about some one else's status as a cheese-liker, it is assumed that it is intended as a contrast. Otherwise, the assertion would appear irrelevant to the previous statement.

If this suggestion is on the right track, then a strict IS difference between "contrastive" and "default" focus would not be desirable. Therefore, the fact that my theory draws no distinction between the two, and in fact uses the exact same prosodic rules to derive both, is a virtue. If it turns out that there is strong and convincing evidence that "contrastive" and "default" focus is a distinction that really does require different treatment within the grammar of prosodic structure or IS, then this virtue might in fact be a liability. Clearly, more research is needed to illuminate this issue.

The point should be emphasized that the uniform treatment of stress assignment in contrastive and default focus falls out naturally from the phase-based theory I have proposed. Furthermore, the phase-based system explains the long-observed connection between IS and stress as simply a by-product of the cyclic nature of phases, not by some special mechanism. In this system, the phonological stress rules apply blindly to each phase, not caring about whether the phase is labeled as iCore or iFrame. In contrast, F-

marking and movement-based theories of IS require the phonological rules to be sensitive

to a feature marking that is clearly semantic in nature. In these theories, the connection

between information and stress is stipulated; in my theory, it falls out as a natural product

of the cyclic nature of the derivation, once we assume that IS partially drives the cycle.

So in this way, the phonological component of my theory is absolutely dependent on the

syntactic component (PICH), but also acts as indirect evidence and felicitous support for

the overall system.

5.5   Remaining issues

In the wake of a proposal this broad, there are a great number of residual issues and areas

for further research. Extended empirical coverage, in terms of additional intonational

contours, further truth-conditional effects, more complex IS articulations, and more

cross-linguistic support are all obvious avenues for exploration and further testing of the

theory. But two elements of the present theory deserve mention as apparent kludges in

the system, which is overall fairly clean. These are the iCore Construction Constraint,

and the Stress Movement Rule, given again below:

(25)   *iCore Construction Constraint* (CCC): within the iCore, the nesting of phases
         must be "hierarchy preserving." They must preserve the nesting of phrase
         structure, and no phase may c-command another phase.

(26)   *Stress Movement Rule*: if a copy to be deleted carries primary stress, transfer
         primary stress to the surviving copy.

The CCC is necessary in order to 1) allow the iCore to dominate non-iCore phases and 2) ensure that stress assignment via the NSR works out when the iCore contains other phases. However, these reasons are admittedly motivated by a need for the theory to match the data, not because of some independent motivation, and as such, the CCC is somewhat of an embarrassment.

This is not to say that the CCC *cannot* have an independent motivation, just that it is not yet clear what that might be. My initial speculation is implicit in the wording of the constraint. I suspect that one of the interface constraints on phase construction, and in the construction of the iCore phase in particular, is that the structure be recoverable and relatively transparent at the surface. It is well-known that when stress falls on the most embedded constituent of a sentence, the IS is ambiguous. To repeat the famous example from Chomsky (1971):

(27)   The police arrested the ex-convict in the red SHIRT.

This utterance can correspond to a large number of possible IS articulations, as shown below:

(28)   Q: Did the police arrest the ex-convict in the red pants?
        A: No, [$_{Fr}$ the police arrested the ex-convict in the red [$_{Co}$ SHIRT]]

(29)   Q: Did the police arrest the ex-convict in the blue pants?
        A: No, [$_{Fr}$ the police arrested the ex-convict in the [$_{Co}$ red SHIRT]]

(30)   Q: Which ex-convict did the police arrest?
        A: [$_{Fr}$ the police arrested the ex-convict [$_{Co}$ in the red SHIRT]]

(31) Q: Who did the police arrest?
       A: [_Fr The police arrested [_Co the ex-convict in the red SHIRT]]

(32) Q: What did the police do?
       A: [_Fr The police [_Co arrested the ex-convict in the red SHIRT]]

(33) Q: What happened?
       A: [_Fr [_Co The police arrested the ex-convict in the red SHIRT]]

However, it is also inconsistent with a large number of other articulations, including:

(34) Q: What did the police do to the ex-convict in the red shirt?
       A: # [_Fr The police [_Co arrested] the ex-convict in the red SHIRT]

(35) Q: Did the police arrest the terrorist in the red shirt?
       A: # No, [_Fr the police arrested the [_Co ex-convict] in the red SHIRT]

(36) Q: Who arrested the ex-convict in the red shirt?
       A: # [_Fr [_Co The police] arrested the ex-convict in the red SHIRT]

Conversely, if the stress is found in a less canonical position, there are fewer possibilities.

If *ex-convict* is stressed, there really can only be one IS articulation:

(37) Q: Did the police arrest the terrorist in the red shirt?
       A: No, [_Fr the police arrested the [_Co ex-CONVICT] in the red shirt]

If the CCC could be violated, however, the following phase structure could result in

assigning primary stress to *police*, even in an out-of-the-blue (i.e., all-Core) context.

(38)   [Fr [Co (phase 3) The police [Phase 2 arrested **[Phase 1 the ex-CONVICT]** in the red shirt]]]

The CCC prevents this, because *the ex-convict* represents a more embedded phase, but a less embedded phrase than *in the red shirt*. That is, the embedding structure of the phases is not isomorphic with the embedding structure of the phrases, and thus the iCore is ill-formed.

However, there may be an alternative to the CCC that is less arbitrary. Thus far, the system has been set up so that phases are "free." In other words, the system tolerates excessive phasing. The interface constraints on phases are seen as forces that will militate for at least the minimal phase structure needed to satisfy IS and the Mapping Hypothesis. This was initially assumed because based on the original argumentation by Chomsky (2000, 2001), phases were a method of reducing computational complexity (by limiting the grammar's access to the lexicon at any given time), and as such, do not have a computational cost that would be subject to considerations of economy.

There may be a better way to look at it, though.[53] The CCC with its clumsy formulation is totally unnecessary if we instead assume that phases need some kind of *licensing* by interface conditions. That is, instead of a system that allows phases willy-nilly, we could imagine a system where every phase must have some interpretational consequence, and therefore must serve some interface requirement. Extraneous, "empty" phases would be disallowed by the system. Considering (38) above, this would rule out exactly the right phase, Phase 1, resulting in stress falling correctly on *shirt*. Phase 2

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[53] Thanks to Andrew Carnie for raising this point.

would be licensed by the Mapping Hypothesis (which requires VP Spell-Out), and the Core and Frame phases would clearly be licensed by informational requirements. This view may have other theoretical implications that may or may not stand up, but for now, it seems like a reasonable assumption, and it has the benefit of allowing us to drop the CCC from the theory, which is a substantial improvement.

The other technical embarrassment is the Stress Movement Rule. Something like this rule has been suggested by others (e.g., Legate 2003), in terms of some kind of stress "inheritance," but it is still a clumsy and strange part of the system. The positive aspect of it is that it is completely a PF rule. PF is responsible for copy deletion, and PF is responsible for stress assignment. It makes a kind of sense that it could deal with both simultaneously. However, when examined closer, it makes less and less sense.

For one, stress assignment is supposed to be cyclic, according to the theory, but this rule allows for modification of stress assignment out of the cycle. The deletion process must happen globally, because it must consider multiple phases at once, otherwise deletion would never happen. But in a sense, since stress assignment happens local to a phase, not globally, the deletion operation happens at a different "zoom level" than stress assignment. This has the feel of unmotivated redundancy, which would appear to run contrary to Minimalist principles.

A second issue is that in essence, stress is being applied to an entire chain, not just to a single prosodic word, which seems odd. It is easy to imagine that the phonology would have a kind of "repair" strategy in case the element bearing primary stress was

deleted, but it is entirely unclear why stress inheritance up the movement chain would be an optimal strategy. Why not simply shift stress over one word to the left?

Again, there may ultimately be reasons to motivate this kind of rule. Perhaps there is some kind of recoverability constraint operating here. Perhaps nuclear stress assignment is more than just grid construction, but rather something more like pitch accent assignment (cf. Selkirk 1984), which might be assumed to attach to a lexical item or chain itself rather than just a metrical position. Or perhaps, as I suggested earlier in the exposition, stress "preservation" by passing stress along a chain is a less costly operation than the original stress assignment, because it does not require assessment of the hierarchical structure of the entire tree. And because copy deletion must necessarily happen late in the derivation, the preservation is also forced to be late, since it is essentially a repair operation in case the copy with primary stress is deleted. For now, I will have to leave the final verdict on this process of stress preservation or "inheritance" as an open question, simply noting that this is an absolutely critical piece of the empirical puzzle, in order for the Mapping Hypothesis and Bresnan (1971) data to work out, even though it raises some interesting and sticky theoretical questions.

5.6   Conclusions

I have taken on a very broad topic, and there are unfortunately many questions left unanswered and details left unaddressed. However, I have shown that not only is it possible to devise a global theory of Information Structure that fleshes out the interfaces with semantics, syntax, and phonology, and that it is possible that such a system could

preserve the spirit of the T-model architecture of grammar, but that in approaching this problem from multiple angles has resulted in a cleaner system overall.

The notion that cyclic Spell Out – phases – provides the mechanism for partitioning utterances into IS categories is central to the theory. Though not strictly necessary for the semantic interface developed in chapter 2, the phase-based structures map very naturally to the nested IS articulations assumed in that chapter. As a unit that provides synchronization between LF and PF interpretational cycles, the phase is a natural locus for effects such as focus-related effects on both interpretation and stress assignment. And because the phases themselves do not require labels or annotations of any kind prior to Spell Out, PF and LF can remain blissfully unaware of the other's doings.

Additionally, though at first blush this appears to be a radical recasting of the phase theory of Chomsky (2000, 2001) and much following work, it turns out to be a rather subtle addition that should not take away from most of the work based on the prior assumptions of phase theory. The key is in the claim that while informational considerations provide a set of interface conditions on phases, IS is not the *only* source of such interface conditions. I argue that the Mapping Hypothesis is another source of interface conditions on phases, and that this will consistently create phases in exactly the places Chomsky originally proposed, CP and *v*P. In general, the effects of this consistency are not marred by the superimposed variability of IS-driven phases, though this theory does predict certain kinds of interactions. In fact, the subtle interaction between phases provided by the Mapping Hypothesis and those driven by IS turns out to

explain an interesting array of recalcitrant data from Diesing (1992), Zwart (1995), and Bresnan (1971), as discussed in chapter 4.

In summary, I have proposed a suite of hypotheses regarding the nature of Information Structure, centered around the proposal that it is isomorphic with at least a subset of phases. This proposal is arguably a more Minimalist re-casting of the phase theory of Chomsky (2000, 2001), and in the process, it does away with the need for rich systems of diacritic marking and movement such as standard F-marking theories (e.g., Jackendoff 1972, Selkirk 1984, Rooth 1985, Büring 1997a) or focus-movement theories (e.g. Rizzi 1997). In fact, the labels of iCore and iFrame themselves are not even necessary in the syntax, since these labels are derivable at the IS interface itself. The labeled brackets I have used throughout are merely notational conveniences for the reader, and not essential for the computational system, at least not in the syntax. The theory also provides a significant simplification in the rules for nuclear stress assignment, by making it possible for a single set of stress assignment rules to produce patterns traditionally labeled as "narrow" or "contrastive" focus, in addition to "default" focus.

Taken together, these advantages indicate an overall more streamlined and simplified theory than most previous theories of IS. Where my theory uses an independently motivated mechanism (phases) to produce a simple two-category partitioning without the need for labels in the syntax, other theories require difficult-to-constrain diacritic features, a proliferation of otherwise poorly motivated functional heads, and/or an overly rich set of IS labels and categories. Where my theory has a single set of cyclic stress-assignment principles, other theories require independent rules

assigning "default stress" (a tenuous notion itself) in some cases and "focus stress" in other cases. Finally, where my theory obeys both the letter and spirit of the strong T-model hypothesis, that phonological rules cannot refer to semantic representations and *vice versa*, other theories must weaken this hypothesis by admitting at least that IS-related phenomena appear to be exceptions to this otherwise successful claim. In short, taken as a whole, in comparison to the theory proposed here, previous attempts to integrate IS with its semantic, syntactic, and phonological interfaces appear overweight and crapulent.

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