

Alternative Semantics

Mats Rooth

Cornell University

Abstract

This chapter presents the semantics and pragmatics of prosodic focus in alternative semantics. Half a dozen examples are given of empirical phenomena that are to be covered by the theory. Then a syntax marking the locus, scope, and antecedent for focus is introduced. The syntax is interpreted semantically and pragmatically by a presupposition involving alternatives. The alternative sets that are used in the definition are computed compositionally using a recursive definition. Alternatives are also employed in the semantics of questions, and this ties in with the phenomenon of question-answer congruence, where the position of focus in an answer matches questioned positions in the question. A different semantic interpretation for focus is entailment semantics, which uses a generalized entailment condition in place of a condition involving alternatives. The semantic and pragmatic interpretation for contrastive topic uses an additional layer of alternatives. Independent of focus, alternatives are deployed in the semantics of disjunction and of negative polarity items.

Keywords: prosody, focus, questions, alternative semantics, contrastive topic, presupposition

1. Introduction

Alternative semantics is a semantic framework that finds application in the analysis of questions, focus, disjunction, negative polarity, presupposition triggering, and implicature. The unifying idea is one of semantic, pragmatic, or discourse-structural operations or constraints referring to “alternative” phrasal meanings. This chapter presents the analysis in alternative semantics of prosodic focus. Some of the other applications are sketched in the last section.

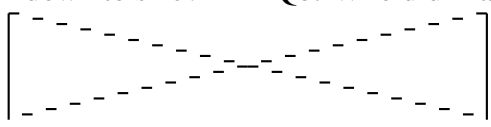
In English, German, Japanese, Korean, and many other languages, there are constructions, discourse configurations, and pragmatic interpretations that show a phonology and phonetics of prominence, and where a common semantic-pragmatic

element related to alternatives and/or redundancy can be identified. We begin with examples of these.¹

Scalar some. The existential determiner *some* is frequently used with a limiting implication. In example (1a), the speaker suggests that only some people can be easily eliminated. Sentence (1b) functions as a correction or hedge, admitting that the group that are supporting Mr. Valentine do not necessarily include the public or all the public. In these utterances, which were made on sports talk shows, the word *some* is noticeably prominent. In sentence (1c) the word *some* was destressed, and here a limiting implication along the lines of “some but not many” would not fit in, because it would undercut the positive message.²

- (1) a. It’s fairly easy to kind of eliminate SOME people like Terry Francona’s wife.
 b. The public right now may be sitting there supporting Bobby Valentine or SOME people are supporting him against Dustin Pedroia.
 c. You know if you’re looking for him to inspire some people in this in this Yankee-Tiger series listen to this.

Questions and answers. When questions are paired with clausal answers, constituents in the answer that correspond to the wh-position in the question are prominent. Thus in (2), the vertical pairings are well-formed question-answer pairs, and the diagonal ones are ill-formed.

- (2) Qa: Who cut Bill down to size? Qb: Who did Mary cut down to size?

 Aa: MARY cut Bill down to size. Ab: Mary cut BILL down to size.

The correlation, which was discussed as early as Paul (1880), is called *question-answer congruence*. Descriptively, answer A is congruent to a question Q if and only if substituting wh-phrases for the focused phrase (or phrases) in A and then performing morphosyntactic adjustments such as wh-movement and do-support can result in Q.

Comparatives. The four utterances in (3) embed the comparative clause *than I did*. The first two were spoken with prominence on the subject pronoun *I*, and the second two were spoken with the subject pronoun destressed. Utterances of this form are covered by a simple descriptive generalization: the subject pronoun is prominent if reference has shifted from the subject position of the main clause to the subject position of the *than* clause, and is destressed when reference is

¹Audio recordings are included in Rooth (2015).

²These examples are drawn from the study in Chereches (2014) of the pragmatics and acoustics of about two hundred tokens of *some* from sports talk shows.

constant (Howell 2011).³

- (3) a. The aquarium got more attention than I did.
- b. Tom actually said it a lot better than I did.
- c. I should have liked that song a lot more than I did.
- d. I understand that a lot more now than I did a few years ago.

Korean indeterminates. Korean indeterminate morphemes such as *nugu* ('who', 'someone') are ambiguous between wh- and existential readings. The wh-reading is reported to have prosodic characteristics of focus, with pitch boosted on the indeterminate morpheme, and reduced pitch following. Sentence (4), which is quoted from Yun (2013), is ambiguous between the three readings in (5). Boosting of prosody on the indeterminate followed by reduced prosody for the rest of the sentence favors a wh-question reading.⁴

(4)	내가	누구하고	결혼하면	돈을	받아
	/næga	nuguhago	kjæronhamjæn	tonil	pada/
	<i>nay-ka</i>	<i>nwukwu-hako</i>	<i>kyelhonha-myen</i>	<i>ton-ul</i>	<i>pat-a</i>
	I-NOM	who-with	marry-if	money-ACC	get-INT
	(Lit. 'I will receive money if I marry [who/someone].')				

- (5) a. I will get money if I marry someone. (Any guy would be okay. Narrow scope existential.)
- b. I will get money if I marry someone. (Though not if I marry someone else. Wide scope existential.)
- c. Who is the person such that I will get money if I marry that person? (wh-question.)

Substitution instances for quantifiers. This scenario comes up frequently in sports talk shows. In a discussion of a specific player, a generalization is stated that is understood to imply an application to the player as a substitution instance. When the phrase *any player* is used as the quantifier in this discourse configuration, the determiner *any* is markedly prominent. See the utterances transcribed in

³Howell looked at several hundred examples of this form from online sources. Listeners who were asked to naively classify prominence listening just to the three words *than I did* behaved in a way that is consistent with the reference criterion about 90% of the time. Machine learning classifiers trained to make the reference-shift decision based on acoustic features in *than I did*, such as duration, formant spread, and pitch are able to make the reference-shift decision with about 90% accuracy from the acoustic features.

⁴In a perception experiment, Yun presented listeners with tokens of such sentences with manipulated pitch contours, and asked them to evaluate fit with paragraph contexts that favored one reading or the other. The wh-reading correlated with the focus-like prosody of boosting and subsequent reduction.

(6).

- (6) a. Well uh I think that uh all the conversations between myself and ANY player uh that are private will remain between myself and the player. I think that's the way we normally handle it, that's how we'll handle it in this case.
- b. You know being Lebron with constant questions about his legacy and this kind of assumption that he's gonna you know he needs to start winning titles pronto or he's a fraud that would be tough for ANY player.

Lists. List-structured phrases show quasi-predictable prominence patterns. (7) is a transcript of a listing of some radio station call signs and their home towns, as spoken by Scott Hollis, a DJ. The call signs were spoken as sequences of four letter-names, and are transcribed using capitals to mark prominence. Prominence falls on the letters where the current call sign differs from the previous one.⁵

- (7) This is wskG fm hd Binghamton, wsQg fm hd Ithaca, wsqE fm hd Corning, wsqA fm hd Hornell, wsqC fm Oneonta.

Contrasting antecedents. In (8), the prominence on the subject in the second sentence can be seen as motivated by contrast with the first sentence.⁶

- (8) Newton discovered calculus. No, LEIBNIZ discovered it.

Farmer sentences. Farmer sentences are sentences with sentence-internal contrasting antecedents, where the contrast is at the nominal level rather than a clausal one, and which can show a dual, symmetric expression of focus. In (9) the first word in *Canadian farmer* is more prominent than the second word, even though the phrase has default prominence on the right. Optionally, prominence can be shifted in *American farmer* as well.

- (9) An AMERICAN farmer told a CANADIAN farmer a joke.

Accommodated contrasts. In many cases, a prominence shift seems to be motivated by a contrast with something that is not overt in the discourse. (10) is a statement by DJ Hollis at the end of a weekly program. The word *next* was prominent. The statement does not require an overt antecedent along the lines of the statement that the DJ is here this week with three hours of great jazz. But the speaker intends for his listeners to accommodate this contrasting antecedent.

- (10) That wraps up Jazz in Sillouette, but remember I'll be back again NEXT week with three more hours of great jazz.

⁵This is obvious in [wsQg], where the prominence is non-final. Probably [wskg fm] is a unit with default prominence to the right, so that even in the first call sign, prominence has shifted to the left. In some cases the town names also sound like they have extra prominence.

⁶See Repp (2016) on phenomena and analysis of this kind of use of focus.

Association with only. John introduced Bill and Tom to Sue, and there were no other introductions. In these circumstances, sentence (11a) is false, while (11b) is true. Contexts like this one where focus has an influence on truth value (or other aspects of compositional semantics, such as semantic presupposition) are known as *association with focus* contexts.⁷

- (11)a. John only introduced BILL to Sue.
- b. John only introduced Bill to SUE.

Reasons. Dretske (1972) pointed out that focus has a truth-conditional effect in counterfactuals, descriptions of reasons, and further contexts that seem to involve underlying counterfactual reasoning. Assuming the situation (12), in the sentences of (13) we observe variation in truth value that is conditioned by the location of focus, just like in the sentences with *only*. Dretske emphasized that such examples show that one has to pay attention to focus in compositional semantics, not just at the discourse and pragmatic levels.⁸

- (12) Pat had two daughters, one named Bertha; the other was named Aretha and was indispensable to him in his business. He had made a commitment to marry one of his daughters to one of the sons of a man who once saved his life. There were two such sons, the elder son Clyde and the younger son Derek. According to the custom of the society and period, an elder son had to marry before his younger brothers; this was known as seniority. Given the commitment, seniority, and the desirability of leaving Aretha free to run the business for him, he figured out that best thing to was to marry Bertha to Clyde, and that is what he did.

- (13)a. The reason he married BERTHA to Clyde was that Aretha was indispensable in the business. *true*
- b. The reason he married Bertha to CLYDE was that Aretha was indispensable in the business. *false*
- c. The reason he married BERTHA to Clyde was that he wanted to obey seniority. *false*
- c. The reason he married Bertha to CLYDE was that he wanted to obey seniority. *true*

Multiple focus. Most of the types of examples discussed above work also with two or more focused phrases, rather than just one. In (14) we see two focused phrases, with a preceding contrasting antecedent sentence. (15) has two focused phrases in an answer to a question with two wh-phrases. Our definition

⁷See Beck (2016) on the analysis of association with focus effects for *only* and similar operators.

⁸(12)–(13) are a version of an example of Dretske's, and are given in this modified form in Rooth (1999).

of question-answer congruence already allowed for multiple F's.

- (14)a. Leibniz invented calculus.
 b. Yea, and Gould_F invented the laser_F.

- (15)a. Who married whom?
 b. Bertha_F married Clyde_F.

This concludes the catalogue of examples. All of them, at least under many accounts, are instances of the same phenomenon of “focus”. This is essentially a grammatically-mediated correlation between a phonology-phonetics of prominence, and semantic-pragmatic factors that are hypothesized to be common to the constructions and discourse configurations.

We turn now to a scheme for annotating three parameters of variation in focus: the *phrasal location* of a focus, the *scope* of focus, and *antecedents* for focus. Jackendoff (1972) introduced the strategy and grammatical hypothesis of localizing focus on surface syntactic phrases, using a focus feature $\pm F$. Usually only the positive value is indicated, using a subscript. When a phrase is F-marked, there is a prominence realizing the focus in the phonological realization of the phrase.⁹

The dialogues (16)-(17) motivate the notion of scope. Questions are numbered using subscripts, and various phrases that do or do not satisfy question-answer congruence relative to the question are marked with a brace. Congruence is annotated as $\sim k$ for the phrase being congruent to question k , and $\not\sim k$ for the phrase not being congruent to question k . The pair (16a,b) is the standard case of question-answer congruence. (16c) is another response to the question (16a), also with focus on *Justin*. Although (16c) is not really an answer to (16a), we can assume that the focus is motivated by congruence to the question. While the entire sentence does not satisfy congruence (pair (16a,d)), the embedded sentential subject does satisfy congruence with respect to the question (pair (16a,c)). In (17), the question is changed, with a resulting switch in the phrases that satisfy congruence. This time the entire sentence does satisfy congruence with respect to the question (pair (17a,c)), and the embedded sentential subject does not (pair (17a,b)).

- (16)a. [who is going to the party]₁
 b. [Justin_F is going]
 c. [for [Justin_F to go]] would surprise me.

⁹Thus the F feature and its scope marker are interpreted phonologically as well as semantically. The phonological interpretation in terms of prominence in a metrical grid that is presented in Myrberg and Riad (2016) is compatible with the representational scheme introduced here.

- d. $\underbrace{[\text{for Justin}_F \text{ to go would surprise me}]_{\lambda_1}}$
- (17)a. [whose going would surprise you]₂
- b. [for $\underbrace{[\text{Justin}_F \text{ to go}]_{\lambda_2}}$] would surprise me.
- c. $\underbrace{[\text{for Justin}_F \text{ to go would surprise me}]_{\sim 2}}$

In this way congruence provides motivation for the hypothesis that the scope of the focus in the dialogue (16a,c) is the embedded sentential subject, and in the dialogue (17a,c), the entire response. Remarkably, the scopes that result from considering congruence agree with a *prosodic* notion of scope. In the dialogue (16a,c), the embedded subject *Justin* is prominent, but it does not outrank the following predicate *surprise me* in prominence—the latter bears the nuclear accent of the sentence. On the other hand, in dialogue (17a,c), *Justin* does bear the nuclear accent. We can hypothesize that in the first dialogue, the phonological domain of prominence for the embedded subject *Justin* is the embedded clause, while in the second dialogue, the domain of prominence for *Justin* is the matrix clause. If so, phonological domains of prominence agree with the scopes that result from the assumption that congruence with respect to the question is to be satisfied. This phonological-semantic isomorphy is the strongest argument for the locus/scope/antecedent grammar of focus.

At this point we have arrived at the notation from Rooth (1992). The scope of F is marked with an operator $\sim k$ in surface trees, where k is the index of an antecedent with respect to which congruence is satisfied. The indices have the status of semantic indices, i.e. indices which correspond to variables in semantics, and/or to discourse referents in a discourse representation. While in many cases antecedents correspond to an overt phrase, they can also be accommodated, as in the *next_F week* example.

The significance of the scope of focus was realized relatively late. In Jackendoff (1972), it seems to be assumed that the semantic scope of focus in our sense is always the matrix sentence. In agreement with this, in the phonology, F-marked phrases take the matrix sentence as their phonological domain, because they bear a special stress feature that is not demoted in the application of cyclic stress rules in the system of Chomsky and Halle (1968). Rooth (1992) discussed non-maximal scope in farmer sentences, using the representation (18). The isomorphy argument was developed in Truckenbrodt (1995), referring to farmer sentences.¹⁰ His point

¹⁰The analysis of focus in Chomsky (1971) referred to representations where the scope of focus is represented by what amounts to movement and bound variables, corresponding to LF movement in subsequent theory. This creates the potential for sub-maximal scope, because movement can be to a submaximal level, such as an embedded clause. But sub-maximal scope was not discussed.

about (18) is that while *Canadian* is maximally prominent in its host nominal, it is not the location for the nuclear accent, which falls on *joke*.

(18) [an American_F farmer]₂~3 told [a Canadian_F farmer]₃~2 a joke.

Notice that in (18), the notion of congruence has been generalized. The antecedent [an American farmer] is hypothesized to be congruent to the host phrase [a Canadian_F farmer], but it is not assumed (or is not necessarily assumed) that the antecedent contributes a question, either directly or indirectly.

A couple of notes are in order about the status of the notation and examples introduced above. The syntactic locus/scope/antecedent notation embodies a grammatical hypothesis, the adequacy of which is not taken for granted. The hypothesis has to be spelled out, notably by articulating the semantic/pragmatic and phonological interpretation for the syntax, and it has to be tested against evidence and compared to competitors.

The examples, in addition to orienting the reader, are intended as an ostensive definition of focus, or of a certain kind of focus. In this it is not assumed prior to analysis that these examples have the same underlying nature. If they do not, then they do not belong in the same theoretical box, and we should countenance several different theoretical notions of focus, or apply different terminology. Sections 2 and 4 of this chapter review analyses which do succeed in identifying a shared deep commonality in the constructions and configurations listed above.

By the way, not every construction in every language that shows question-answer congruence is necessarily an instance of the kind of focus under discussion here. The arguments reviewed in É. Kiss (2010) and É. Kiss (2016) indicate that the structural or movement focus found in Hungarian has a distinct semantics from English-type prosodic focus, and a distinct distribution. Yet movement focus is used in default answers in Hungarian, and shows question-answer congruence. In general, we should resist giving any kind of substantive definition of focus prior to analysis, referring either to question-answer congruence, the evocation of alternatives, or a broadly information-theoretic notion of the focus being unpredictable relative to the rest of the material in the scope of the focus. The fundamental problem with starting in this way is that it prejudices the issue of what the optimal theoretical account is. Interesting terms in scientific theories do not have non-ostensive definitions that are independent of theories.

Jacobs (1983), Rooth (1985), and von Stechow (1991) gave semantically oriented accounts that generate sub-maximal focus scopes, while hardly talking about examples with embedded scope.

2. Semantic interpretation

Consider (19), where the clause $[\phi \sim k]$ embeds a focused phrase and is indexed to a preceding contrasting clause. We assume a system of interpretation where clauses semantically contribute propositions, e.g. as constructed in possible worlds semantics. Suppose **discover** is a two-place function from individuals to propositions. Then the antecedent in (19) denotes the proposition $\mathbf{discover}(n, c)$, and the host clause for the focus denotes the proposition $\mathbf{discover}(l, c)$. Informally, the antecedent proposition is an alternative to the host proposition that can be obtained by making a “substitution” in the position of the focused phrase. This is the core idea of alternative semantics: a legitimate antecedent for focus denotes an alternative to the scope of the focus, or as we will see in a moment, a set of alternatives.

$$(19) \quad \begin{array}{l} \text{[Newton discovered calculus]}_2 \\ \text{No, } \underbrace{\text{[Leibniz}_F \text{ discovered calculus]} \sim 2}_{\phi} \end{array}$$

The notion of making substitutions in the focus positions of propositions need not be taken literally. For one thing, propositions as constructed in possible words semantics do not have positions—they are unstructured sets of worlds. For another, some way of tracking the focus positions from the syntax to the semantics is needed. For now, we will just assume that the semantics of the language makes available, in addition to an ordinary semantic value (which is a proposition in the case of a clause), a set of eligible alternatives, which for a clause is a set of propositions. The set of alternatives is a “focus semantic value”, or “alternative semantic value”. The focus semantic value for ϕ in (19) can be expressed formally as in (20), using set abstraction.¹¹ It is the set of propositions that can be obtained by plugging in some individual for y in the open proposition-naming term $\mathbf{discover}(y, c)$. Hamblin (1973) introduced a useful informal way of naming such alternative sets. We say that the alternative set is the set of propositions of the form ‘ y discovered calculus’.

$$(20) \quad \begin{aligned} \llbracket \text{[Leibniz}_F \text{ discovered calculus]} \rrbracket^o &= \mathbf{discover}(l, c) \\ \llbracket \text{[Leibniz}_F \text{ discovered calculus]} \rrbracket^f &= \{p \mid \exists y. y \in D_e \wedge p = \mathbf{discover}(y, c)\} \\ &= \{\mathbf{discover}(y, c) \mid y \in D_e\} \end{aligned}$$

Now we are ready to formalize this simple idea: a phrase of the form $\phi \sim k$ is associated with the constraint that the antecedent k is an alternative to the semantic object contributed by ϕ . The set of eligible alternatives is $\llbracket \phi \rrbracket^f$, so we require that

¹¹The “destructuring” set abstraction notation $\{\mathbf{discover}(y, c) \mid y \in D_e\}$ is potentially ambiguous, because one has to know whether y is allowed to vary, or is held constant. In this chapter, all free variables before the bar are allowed to vary over the combinations of values that satisfy the constraint after the bar.

the semantic element k be an element of the alternative set. (21) says in addition that k should be different from the ordinary semantic value $\llbracket \phi \rrbracket^o$.

(21) Alternative licensing (first version)

$\phi \sim k$ requires that the semantic element k is an element of $\llbracket \phi \rrbracket^f$ that is distinct from $\llbracket \phi \rrbracket^o$.

The terminology “the semantic element k ” is explained in the same way as with other varieties of indexing, such as indices on traces and pronouns. In a standard formulation of a static semantics, values for variables are given by assignment functions, so the semantic object is $g(k)$, where g is the assignment function. It is natural to think of the index k as a discourse referent in a discourse representation, which may be projected from a syntactic index, but also may be constructed. The framework should make available discourse referents of all types, including propositions. So the picture is that the first sentence in (19) sets up a propositional discourse referent 2, which is used as an antecedent in checking the focus constraint for the second sentence. So while $\phi \sim k$ is a piece of syntax, the focus constraint is checked semantically.

The licensing condition (21) covers cases where the antecedent has the same type as the host phrase for the focus. When the host phrase is a clause and has the propositional type, the contrasting object is a proposition. When the host phrase denotes a generalized quantifier as in the former sentence (9), the antecedent is also a generalized quantifier. This does not work when the antecedent is a question and the host phrase is a declarative answer, because questions and statements have different semantic types. This brings up the connection between alternative semantics for focus and the alternative semantics for questions that was proposed in Hamblin (1973). Hamblin’s semantics can be viewed as being motivated by the principle that any viable semantics for questions must be capable of characterizing what counts as an answer. One way of meeting this constraint is to take the semantics of a question to be a set of propositions, the set of atomic answers to the question, independent of truth of the answers. So the semantic value of the question (22a) is the set of propositions of the form ‘ y invented calculus’, where y is a person. This is nearly the same as the focus semantic value of the answer (22b). This suggests generalizing the congruence condition, so that the antecedent can be a *set* of alternatives, rather than a single alternative. (23) is a way of stating this. The idea is that since the alternative propositions in the semantics of the question are restricted to people, while the alternatives in the focus semantic value are unrestricted, the antecedent is a proper subset of the focus semantic value. Rooth (1992) also included the condition that the ordinary semantic value of the scope of the focus is an element of the antecedent, and that the antecedent has cardinality of at least two. These conditions, which in a way correspond to the distinctness condition in part (i) of (23), are included in part (ii).

- (22)a. [who invented calculus₂]₃
 b. [Leibniz_F invented it₂]₃
- (23) Alternative licensing (second version)
 $\phi \sim k$ requires that the semantic element k is either
 (i) an element of $\llbracket \phi \rrbracket^f$ that is distinct from $\llbracket \phi \rrbracket^o$, or
 (ii) a subset of $\llbracket \phi \rrbracket^f$ of cardinality at least two that includes $\llbracket \phi \rrbracket^o$.

A different way of going is to set up the semantics so that the focus semantic value itself gets restricted. Suppose that in generating alternatives for (22b), only people are substituted for Leibniz, so that we get the set of alternatives of the form ‘ y invented calculus’, where y is a person. Then the focus semantic value of the answer would match the semantics of the question exactly.

3. Composing alternatives

The interpretation principle for the focus scope configuration $[\phi \sim k]$ refers to the alternative set $\llbracket \phi \rrbracket^f$ for the phrase ϕ . This section looks at how the alternative set is derived. Hamblin (1973) and Rooth (1985) suggested a recursive strategy: there are alternatives “all the way down”, and the alternatives propagate up the tree. Figure 1 shows a binary-branching tree for sentence (24b). This is a multiple-focus example, where alternatives are generated from the focused subject *Aretha_F*, and the focused object *Clyde_F*. In the tree, each node is annotated with its ordinary semantics, and below that, an alternative set. To control the size of the sets, we assume that there are just three entities in the model, namely entity **a** (Aretha), entity **b** (Bertha), and entity **c** (Clyde). At the top, we see the ordinary semantics **introduce(a, b, c)**, and an alternative set that contains alternatives such as **introduce(c, b, a)**. There are nine alternatives, resulting from multiplying a choice among three in the subject position by a choice among three in the object position. This is the set of propositions of the form ‘ y_1 introduced y_2 to Clyde’ in this simple model. Looking at the bottom of the tree, the alternative set for the focused subject is $\{c, b, a\}$, the set of individuals in the model. The same goes for the focused object. This is how alternatives are “launched”: the alternative set for a focused phrase (whether it is a terminal or not) is the set of semantic objects that match the ordinary semantic value of the phrase in type. Non-focused terminals are given a trivial alternative set, namely the unit set (singleton set) of the ordinary semantic value of the phrase. Since $\llbracket \text{Clyde} \rrbracket$ is **c** and the phrase is not focused, its focus semantic value is the unit set $\{c\}$.

- (24)a. Who introduced whom to Clyde?
 b. *Aretha_F* introduced *Bertha_F* to Clyde.

If a complex phrase is focused, it goes by the rule already given—its alter-

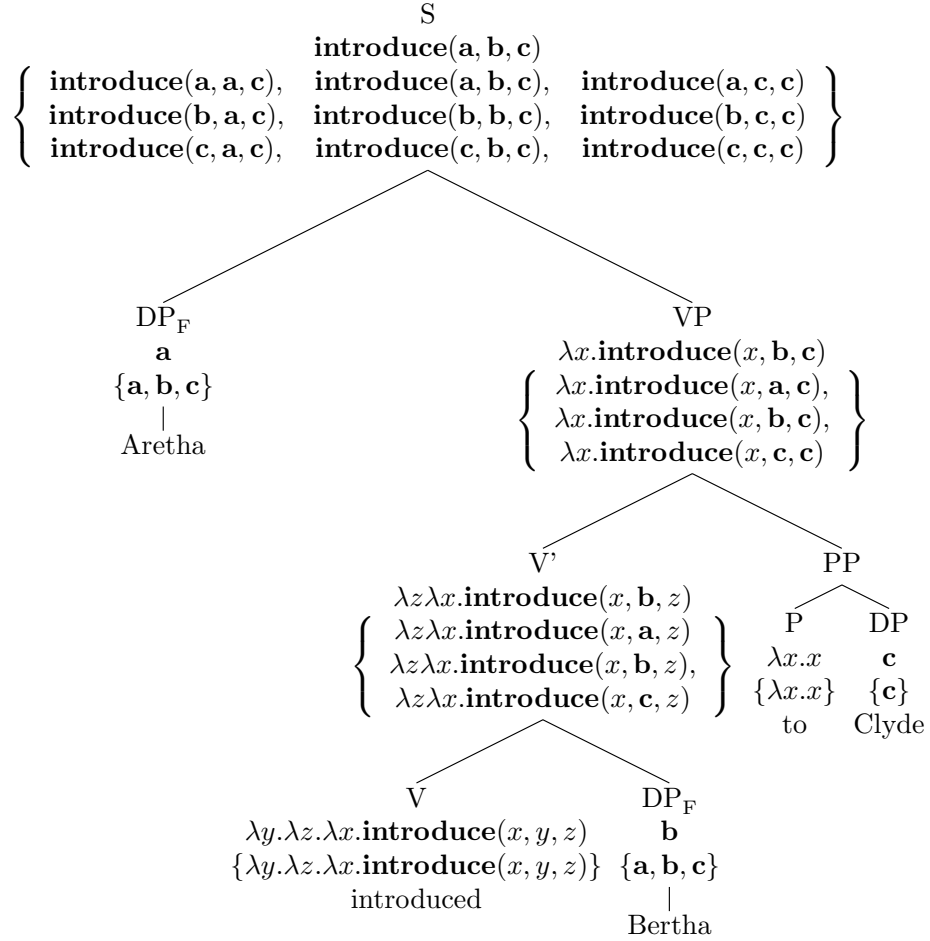


Figure 1: Recursively computed alternatives in a syntactic tree. Each node is annotated with its ordinary semantics, and below that a focus alternative set. The domain of individuals is $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$.

native set is the set of semantic objects matching the ordinary semantics of the phrase in type. So for instance, the alternative set for a focused VP is the set of all properties. Alternative sets for non-focused complex phrases are derived from the alternative sets for their children. Suppose we have a complex phrase with children α and β . Say α is semantically the function, so that the ordinary semantics is formed as $\llbracket \alpha \rrbracket (\llbracket \beta \rrbracket)$. If we pick any element f of $\llbracket \alpha \rrbracket^f$, and any element y of $\llbracket \beta \rrbracket^f$, they can also be combined as function and argument. The alternative set for $[\alpha\beta]$ is the set of all semantic objects $f(y)$ that can be formed in this way. (25) illustrates this for the phrase $[\text{introduce Bertha}_F]$, where the verb is the function. There is one choice for f in $\llbracket \text{introduce} \rrbracket^f$, and there are three choices for y in $\llbracket \text{Bertha}_F \rrbracket^f$. From these, three semantic objects can be formed as $f(a)$, as shown in (25).

$$(25) \quad \begin{array}{l} \text{introduced} \\ \text{Bertha}_F \\ \\ \text{introduced Bertha}_F \end{array} \quad \begin{array}{l} \{\lambda y.\lambda z.\lambda x.\text{introduce}(x, y, z)\} \\ \{\mathbf{a}, \mathbf{b}, \mathbf{c}\} \\ \left\{ \begin{array}{l} \lambda z\lambda x.\text{introduce}(x, \mathbf{a}, z), \\ \lambda z\lambda x.\text{introduce}(x, \mathbf{b}, z), \\ \lambda z\lambda x.\text{introduce}(x, \mathbf{c}, z) \end{array} \right\} \end{array}$$

Generalizing a bit, let h be the semantic rule that is used to combine $\llbracket \alpha \rrbracket$ with $\llbracket \beta \rrbracket$ in the phrase $[\alpha\beta]$. Then $\llbracket \alpha\beta \rrbracket^f$ is defined to be the set of all semantic objects that can be formed as $h(x, y)$, where x is an element of $\llbracket \alpha \rrbracket^f$ and y is an element of $\llbracket \beta \rrbracket^f$.¹² In this case $\llbracket \text{introduce Bertha}_F \rrbracket^f$ is obtained as the image of the rightward function-application operator f_{RFA} acting on $\llbracket \text{introduced} \rrbracket^f \times \llbracket \text{Bertha}_F \rrbracket^f$.

Another way of defining alternatives is to introduce a variables in the F positions that have the same type as the ordinary semantic value (Kratzer 1991, Wold 1996). For this purpose a separate family of variables is used. Focus semantic values have the same type as ordinary semantic values, and have variables in the focus positions. (26) illustrates this for the example in Figure 1, using the u variables with subscripts for the special focus variables. In this system, there are no alternatives at recursive levels. Instead, alternatives are introduced in defining \sim operator, by making substitutions for the special focus variables.

(26) <i>phrase</i>	<i>focus semantic value</i>
introduced	$\lambda y.\lambda z.\lambda x.\text{introduce}(x, y, z)$
Bertha_F	$u_{e,1}$
introduced Bertha_F	$\lambda z.\lambda x.\text{introduce}(x, u_{e,1}, z)$
Clyde	\mathbf{c}
introduced Bertha_F to Clyde	$\lambda x.\text{introduce}(x, u_{e,1}, \mathbf{c})$
Aretha_F	$u_{e,2}$
Aretha_F introduced Bertha_F to Clyde	$\text{introduce}(u_{e,2}, u_{e,1}, \mathbf{c})$

Either of these approaches provides a workable solution to the problem of defining focus alternative sets, in the service of making available the semantic objects that are used in the definition of the \sim operator.

Hamblin applied alternative semantics to questions. This works in the same way as alternative semantics for focus in the recursive part. There is an issue though about how to treat the restrictive property of the wh-phrase, which interacts in a subtle way with question-answer congruence. Consider the examples in (27), where the wh-pronoun has a lexical restriction to persons, the wh-phrase *what dog* has a restriction to dogs, and the wh-phrase *what Thai restaurants* has a restriction to Thai restaurants. One option is to equate the alternative set for the wh-phrase with the extension of the restriction, so that $\llbracket \text{who} \rrbracket^f$ is the set of people.

¹²Mathematically, this is an image construction (Hamblin 1973, fn. 8). In general the image of a function h on a subset Z of its domain is the set of values $h(z)$ that can be obtained by applying h to an element z of Z . In (25), $\llbracket [\alpha\beta] \rrbracket^f$ is the image of the rightward function application operator on the cross product $\llbracket \alpha \rrbracket^f \times \llbracket \beta \rrbracket^f$.

- (27)a. Who is awake?
 b. What dog walks with Mary?
 c. What Thai restaurants are in the neighborhood?

In this passage, Hamblin describes this “restricting” option, argues against it, and proposes an alternative “conjunctive” option.

We would like to think that the phrase *what dog* could be treated as an interrogative proper name denoting the set of dogs, and that *what dog walks with Mary* has as answers just the set [of propositions of the form] ‘*x* walks with Mary’ where *x* is the name of a dog. But the composition of the set of dogs does not necessarily remain constant from universe to universe: in some universes Rover may be a horse, and Mary herself a dog. I have taken the attitude that when someone answers *what dog walks with Mary* with *Rover* he states not merely that Rover walks with Mary but also implicitly that Rover is a dog, and hence that he states the conjunction. [Hamblin 1973:51, with adjustments in quotation styles.]

The proposal then is that the alternative set for (27a) is the set of propositions of the form ‘*x* is a person and *x* is awake’, and that the alternative set for (27b) is the set of propositions of the form ‘*x* is a dog and *x* walks with Mary’. This can be formulated by defining the alternative sets for *who* and *what* at the generalized quantifier level as in (28).

$$(28) \quad \llbracket \text{who} \rrbracket^f = \{ \lambda Q. \lambda w. \mathbf{human}(w, x) \wedge Q(x)(w) \mid x \in D_e \}$$

$$\llbracket \llbracket \text{what} \rrbracket \rrbracket^f = \{ \lambda P. \lambda Q. \lambda w. P(x)(w) \wedge Q(x)(w) \mid x \in D_e \}$$

The conjunctive interpretation is not compatible with the theory of question-answer congruence from Section 2. The representation (29) is licensed if the alternative value for the question is a subset of the alternative value for the answer. In any realistic model, it is not, because for instance ‘Justin is human and walks with Mary’ is an element of the alternative value for the question, but not an element of $\llbracket \text{Justin}_F \text{ walks with Mary} \rrbracket^f$, which is the set of propositions of the form ‘*x* walks with Mary’.

$$(29) \quad [\text{who walks with Mary}]_1 [\text{Justin}_F \text{ walks with Mary}] \sim 1$$

Treatments of question-answer congruence in alternative semantics have assumed the restrictive strategy in the semantics of questions (Rooth 1992). But what about Hamblin’s point that there is no stable set of propositions of the form ‘*x* walks with Mary’, where *x* is a human, because the sets of humans are different in different possible worlds? Relatedly, there is a worry that the focus constraint is trivialized in certain cases. In a world where there are no nuclear engineers, the denotation of the question (30a) is the empty set. Therefore the subset constraint

coming from focus interpretation in (30b) is trivial. This is not quite a problem, because the oddity of the pair (30a,b) can be attributed to the logic and pragmatics of the question-answer relation, rather than anything about focus. In any viable account of the question-answer relation, the proposition contributed by (30b) is not an answer to the question (30a). So to rule out this question-answer dialogue, it is not necessary to appeal to the focus presupposition. But if we fix this by adjusting the response as in (30c) (perhaps the cat being on the mat would prevent any dancing), focus in the cat-clause is still not licensed.

- (30)a. [what nuclear engineers danced with Mary]_i
 b. [[the cat]_F is on the mat]~1
 c. [Since [[the cat]_F is on the mat]~1 [none did]~1]

The right move here is to accept that question alternative sets are world-dependent. This is explicit in the analysis of indeterminate pronouns in Kratzer and Shimoyama (2002). They give the semantics (31) for the Japanese indeterminate pronoun *dare*, which has a use as a WH-pronoun. Here the alternative set of individuals contributed by *dare* varies from world to world, since there is reference to the world of evaluation w in the restrictive clause of the set abstraction.

$$(31) \llbracket \text{dare} \rrbracket^{f,w,g} = \{y | \mathbf{human}(w, y)\}$$

Using the same definition for *who* results in the denotation given in (32a) for the question in (29a). Here I have switched to a notation for propositions that has explicit reference to worlds. $\lambda v. \mathbf{walkwith}(v, y, \mathbf{m})$ is the set of worlds v in which y walks with Mary; this was earlier written $\mathbf{walkwith}(y, \mathbf{m})$, without commitment to modeling propositions as sets of worlds. The set (32a) is world sensitive, because there is reference to the world of evaluation w in the restriction of the set abstraction.

$$(32)\text{a. } \llbracket \text{who walks with Mary} \rrbracket^{f,w,g} = \{\lambda v. \mathbf{walkwith}(v, y, \mathbf{m}) | \mathbf{human}(w, y)\}$$

$$\text{b. } \llbracket \text{Justin}_F \text{ walks with Mary} \rrbracket^{f,w,g} = \{\lambda v. \mathbf{walkwith}(v, y, \mathbf{m}) | y \in D_e\}$$

(32b) gives the focus denotation for the answer in the same notation. This set is not world sensitive. Nevertheless for any world w , the question alternative set (32a) is a subset of the focus alternative set (32b). Applying the constraint in each world is exactly what falls out if the congruence constraint is modeled as a presupposition. For comparison, consider the semantics of the second sentence (33) in a static semantic model of presupposition. The sentence intuitively presupposes that Kim is male. This is captured by the assignment of the third (undefined) truth value when Kim is not male in the world of evaluation. In the pragmatics, a common ground model of presupposition checks the presupposition in each world that is an element of the context set of the common ground. This captures the fact that the discourse is perceived as taking for granted that Kim is male.

- (33) Have you heard? Keisha is dating Kim₂. Go figure. The guy₂ is expert at tango and she hates to go out.

So, if it is formalized semantically as a distributive presupposition that places a constraint on a world, it falls out of the pragmatic interpretation of such presuppositions that the constraint gets imposed in all worlds of the context set. This addresses the worries about the question alternative set not being stable, and about the focus constraint being trivial in some cases.

Summing up, to fit alternative semantics for focus in with a generally Hamblin-like alternative semantics for questions, the restricting version of Hamblin semantics for questions has to be used. Hamblin’s official conjoining option does not result in values that satisfy the presupposition of the focus redundancy operator in configurations of question-answer congruence.

4. Entailment semantics

According to Section 2, the presupposition of the focus-scope operator is satisfied when the indexed antecedent is an alternative to the semantic value of the argument of the operator, or a set of alternatives. This section looks at a different licensing condition due to Schwarzschild (1999). This says that the semantics of the antecedent should *entail* a semantic object derived from the focus semantic value of the scope of the operator, in a certain generalized sense.¹³ Consider the example repeated in (34). The first step is to derive the *focus closure* from ϕ . This is a proposition with existentially quantified variables in the position of each free F. Formally, it can be obtained as the union of the focus semantic value, $\bigcup \llbracket \phi \rrbracket^f$. Next entailment is checked between the antecedent and this closure. In this case, the antecedent proposition ‘Newton invented calculus’ does entail the closure ‘some entity invented calculus’, and the representation is licensed.

- (34) [Newton invented calculus]₄. [Leibniz_F invented it]₄ ~ 2.

So, in cases where both the antecedent and ϕ have propositional type, the presupposition introduced by the configuration $[\phi \sim k]$ is that the antecedent proposition entails the focus closure for ϕ . Look now at (35), where for the sake of argument we assume that the focus on *Canadian* takes scope at NP. This constituent has the property type, rather than a propositional one. Here it is proposed

¹³Schwarzschild’s proposal was cast in a different way from the framework under discussion here. See Rochemont (2016) for a presentation of this Givenness framework. A couple of aspects of Schwarzschild’s proposal are independent of the entailment condition. The most important of these is that the hypothesis that the redundancy operator need not scope over F. In (34), the pronoun *it* is destressed, and this is attributed to the pronoun being ‘given’ relative to its antecedent *calculus*, in the same sense that the scope of an F is given or redundant with respect to its antecedent. Under the scheme presented here, the pronoun is represented as $[it_4 \sim 4]$, with the operator ~ 4 not scoping over F.

that the property type is lowered to the propositional one, by existentially quantifying the argument. The same type adjustment is performed for the antecedent. The result in this case is the proposition ‘there are American farmers’ for the antecedent and for the scope (applying also focus closure) ‘there are farmers’. The former entails the latter, and the constraint is satisfied.

(35) Every [American farmer]₃ is a [_{NP}Canadian_F farmer]_{~4}.

Neatly, type shifting works out even in question-answer congruence, where the antecedent is a question, providing that Karttunen’s semantics for questions is used, where the question alternative sets are restricted to true propositions (Karttunen 1977). In (36), the existential closure of the antecedent relative to a base world w is the proposition that there is some proposition of the form ‘ y invented calculus’ that is true in w such that y is a person in w . This is equivalent to ‘some person invented calculus’, while the focus closure for the scope is ‘some entity invented calculus’. Since these stand in the relation of entailment, the indexed redundancy operator is licensed.

(36) [Who invented calculus]₄₂. [Leibniz_F invented it]₄_{~2}.

So far we have not seen any cases where entailment licensing and alternative licensing give different results. A simple one is where the antecedent is existentially quantified (Rooth 2005). Since somebody eating the cake entails some entity eating it (the latter is the focus closure), the representation (37) is licensed. But if we try alternative licensing, the proposition ‘somebody ate the cake’ is neither a proposition of the form ‘ y ate the cake’, nor a set of propositions of that form.¹⁴

(37) [Somebody ate the cake]₄₂. Yea, [Gottfried_F ate it]₄_{~2}.

For an argument the other way, we can exploit the fact that focus and existential closure of the scope result in weak existentially quantified propositions, so it can be too easy for an arbitrary antecedent to entail them. In (38b), there is focus on the generalized quantifier *every cat*, with sentence scope. In (38c), there is focus within the subject generalized quantifier, and taking scope at it. In both cases, the closure procedure results in trivial propositions. (39a) is the focus closure obtained in (38b). This is necessarily true. Here is reason. Every entity that tasted the flounder filets tasted the flounder filets. Therefore the property of tasting the flounder filets serves as a witness for the existential quantifier $\exists P$. Since (38a) is necessarily true, it is entailed by any antecedent, and the licensing condition for the pair (38a,b) is satisfied. This is bad result. In the pair (38a,c), argument closure as well as focus closure apply, because the scope is a generalized quantifier, rather than a proposition. This results in the closure (39b), which by similar

¹⁴This counterexample is undone if existential quantifiers contribute alternative sets. See Section 6. Also, it is somewhat plausible to posit an accommodated question ‘who ate the cake’ following the first sentence. This would serve as the antecedent.

reasoning is trivially satisfiable. So the representation (38a,c) is licensed, again a bad result.

- (38)a. [I left some flounder filets₄ on the counter]₂
 b. [[every cat]_F tasted them]_{~2}
 c. [[every [cat_F]]_{~2} tasted them]

- (39)a. $\exists P.\forall x.P(x) \rightarrow \mathbf{taste}(x, g(4))$
 b. $\exists P.\exists Q.\forall x.P(x) \rightarrow Q(x)$

Summing up, generalized entailment is another proposal for the presupposition of $\sim k$. Relative to the alternatives presupposition from Section 2, it has some advantages and some disadvantages. There is a need for deeper investigation of this issue.

5. Topic alternatives

This section looks at an extension of alternative semantics that posits a higher level of alternatives, consisting essentially of alternatives to alternative-sets. This was proposed in Büring (1997) as a way of theorizing about the discourse pragmatics of contrastive topics. As discussed in Büring (2016) and Velleman and Beaver (2016), discourses involving multiple wh-questions and sub-questions can trigger answers that combine focus with an additional prominent element, called the contrastive topic. In sentence (40), focus on *Manny* correlates with the WH position in the immediately preceding question. Contrastive topic on the subject is somehow triggered by the complex discourse context. (41) illustrates that the pattern can be reversed, with focus followed by contrastive topic (Jackendoff 1972). Contrastive topic and focus strike many speakers as different prosodically, and experimental work has shown that they can be pronounced in ways that differ consistently in pitch contour (Lieberman and Pierrehumbert 1984).¹⁵ Current accounts that use the phonological tone model from Pierrehumbert (1980) transcribe the topic constituent L+H* within a phrase with L-H% boundary tones, and the focus as H* within a phrase with L-L% boundary tones.¹⁶

- (40) (who came with whom?)
 What about Anna? Who did she come with?
 Anna_{CT} came with Manny_F.

- (41) (who came with whom?)
 What about Manny? Who came with him?

¹⁵The examples in (40) come from this paper.

¹⁶Among studies concerned with the semantics interface for prosodic phonology, see Steedman (2000, 2014), Büring (2003), and Constant (2012).

Anna_F came with Manny_{CT}.

In (40) and (41), the answers are congruent with the questions they answer, if CT is ignored. Therefore it can be hypothesized the CT feature does not affect focus semantic values, and that congruence is represented with indexing to the question as before. Suppose the extra contribution of contrastive topic is conceptualized as a contrasting question, which is also represented with an index. The contrasting question stands in a relation of substitution contrast with the focus antecedent, with substitution in the CT position. This leads to representations like (42) and (43), with an additional argument of the focus redundancy operator. In both cases, the question with index 4, namely ‘who did Keisha come with’ can be obtained from the question with index 2, namely ‘who did Anna come with’, by making a substitution in the CT position.

- (42) (who came with whom?)
[who did Anna come with]₂
[Anna_{CT} came with Manny_F]₃ ~ 2, 4
([who did Keisha come with]₄)
- (43) [who did Keisha come with]₄
([who did Anna come with]₂)
[Anna_{CT} came with Manny_F]₃ ~ 2, 4

In each of these representations, one antecedent is overt, and the other accommodated. In dialogue (42), we can conceive of the question with index 4 as a question which remains open, under the general discourse topic of who came with whom. In dialogue (43), the respondent switches the discourse topic from the question of who Anna came with to the question of who Keisha came with. The focus antecedent is accommodated, while the contrastive topic antecedent is the overt question.

Adding CT adds another dimension to the compositional problem. Büring (1997) followed the recursive strategy by defining an additional alternative semantic value $\llbracket \cdot \rrbracket^t$. The focus semantic value of [Anna_{CT} came with Manny_F] can be conceptualized as the Hamblin question ‘Anna came with what entity’. The topic semantic value is then obtained by making substitutions in the CT position, yielding the set of Hamblin questions of the form ‘z came with what entity’, where z is an individual. Definition (44) gives recursive clauses defining topic semantic values.¹⁷ The third line defines the topic semantic value for a topic-marked phrase as the set of singleton sets of singleton sets of elements of the semantic domain for the phrase. In our example, this generates questions with individual substitutes for the topic-marked phrase subject, for instance ‘Keisha came with what entity’ and ‘Hannah came with what entity’. The second line defines the topic semantic value

¹⁷Section 3.3.1 of Büring (1997) gives a definition along these lines that deals also with free variables and lambda.

of an F-marked phrase as the unit set of the focus semantic value. This has the effect of making elements of the topic semantic value look like the focus semantic value in F positions. For instance, the element ‘Hannah came with what entity’ of the topic semantic value has variation in the position of the object of *with*, just like the focus semantic value ‘Anna came with what entity’.

- (44) (i) $\llbracket \alpha \rrbracket^t = \{ \{ \llbracket \alpha \rrbracket^o \} \}$,
if α is a terminal that is not F-marked
(ii) $\llbracket \alpha_F \rrbracket^t = \{ \llbracket \alpha \rrbracket^f \}$
(iii) $\llbracket \alpha_{CT} \rrbracket^t = \{ \{ y \} \mid y \in D_\tau \}$
(iv) $\llbracket [\alpha\beta] \rrbracket^t = \{ c \mid \exists a \exists b. a \in \llbracket \alpha \rrbracket^t \wedge b \in \llbracket \beta \rrbracket^t \wedge c = \{ F(x, y) \mid x \in a \wedge y \in b \} \}$,
where $[\alpha\beta]$ is not F-marked or CT-marked.
 F is the semantic operation for $[\alpha\beta]$.

The two-place redundancy operator can now be defined as in (45). j is the index of the local question. As before, this question is presupposed to be a subset of the focus semantic value. k is the index of the contrasting question. The contrasting question is selected from the topic semantic value, which can be thought of as the set of potential contrasting questions. The subset condition is included to allow for contextual narrowing of the contrasting question, just as for the congruent question.

- (45) $\llbracket \phi \sim j, k \rrbracket^g$ presupposes that $g(j)$ is a subset of $\llbracket \phi \rrbracket^f$ and that $g(k)$ is a subset of an element of $\llbracket \phi \rrbracket^t$ that is distinct from $\llbracket \phi \rrbracket^f$.

This formulation allows possible contrasting question antecedents to be characterized semantically, just like focus antecedents, and licenses the representations (42) and (43). This assumes that the presupposition associated with CT is satisfied by the presence in the discourse representation of a question that satisfies the semantic constraints on the antecedent. Much of the literature however works with more specific constraints which say that question antecedents have to be in specific positions in a tree-structured model of discourse state. See Roberts (1998/2012), Büring (2003), and Büring (this volume).^{18 19}

This is a good place to talk about the discourse pragmatics that goes with the

¹⁸Another feature of recent work is the hypothesis that *both* the local and contrasting questions are drawn from the topic semantic value, using the fact that by construction, the focus semantic value is an element of the topic semantic value (Büring 2003). This move is motivated by desire to characterize possible antecedent questions in a maximally general way.

¹⁹An alternative to the recursive dual-layer system of alternatives is given by Constant (2012), who works from a representation with a CT head that is realized by the contrastive topic boundary tones. It has two arguments, each of which embeds F constituents that are interpreted in alternative semantics in the normal way. In the structure (i), both the contrastive topic and the focus are analyzed as bearing F features. The distinction between the two is encoded in the semantics of CT, which manipulates focus semantic values.

(i) Anna_F CT e₁ came with Manny_F.

locus/scope/antecedent representation for focus from Section 2, and the semantic interpretation for it from Sections 2 and 4.²⁰ Those interpretations took the form of presuppositional constraints on the antecedent k in the configuration $[\phi \sim k]$. A constraint is placed on the semantic object k : it is required to be an alternative to $[[\phi]]$ in the sense defined by the focus semantic value, a set of alternatives, or in the formulation from Section 4, to entail the focus closure for ϕ in a generalized sense of entailment. Eligible antecedents for k are discourse referents that have the right semantic type, and which satisfy the focus constraint. Pragmatically, a speaker who uses a sentence containing focus and $\phi \sim k$ signals an intent to assume a discourse representation containing an antecedent that is identified by indexing, which should be salient in the same way that antecedents for pronouns and anaphoric definite descriptions are salient. Discourse referents that provide antecedents for focus can be projected from syntactic phrases. They can also be constructed, as exemplified by the accommodated question antecedents marked with parentheses in (42) and (43).

6. More applications of alternative semantics

The discussion so far has looked at the application of alternative semantics to intonational focus, with a short consideration of alternative semantics for questions. The same or a similar framework is applied to other phenomena in semantics and pragmatics.

Aloni (2003), Simons (2005), and Alonso-Ovalle (2006) have presented analyses in which natural language disjunctions contribute alternatives. The analysis in Alonso-Ovalle (2009) of conditionals such as (46a) is representative. It is argued that combining a boolean semantics for *or* with a minimal-change semantics for counterfactuals (Stalnaker 1968; Lewis 1973) gives bad results, because on reasonable assumptions about what worlds count as ‘normal’ or similar to our own, worlds where we have good weather are much more normal than ones where the sun grows cold. With this background assumption, sentence (46a) comes out as equivalent to (46b). Instead it seems to be equivalent to (46c).

- (46)a. If we had had good weather this summer or the sun had grown cold, we would have had a bumper crop.
- b. If we had had good weather this summer, we would have had a bumper crop.
- c. If we had had good weather this summer, we would have had a bumper crop and if the sun had grown cold, we would have had a bumper crop.

Alonso-Ovalle analyses these data using the hypothesis that the material inside the if-clause, instead of contributing a proposition, contributes the set of proposi-

²⁰Sæbø (2016) articulates a discourse-pragmatic model along these lines.

tions containing ‘we have good weather this summer’ and ‘the sun grows cold’. Then a quantificational semantic rule for the way that *if* combines with the clause headed by *would* is stated which has the effect of using the elements of the alternative set independently as restrictions for *would*, in order to obtain a reading equivalent to (46c).

Krifka (1995) introduced the hypothesis that “weak” negative polarity items such as *any* introduce alternatives into the semantic derivation. Negative polarity items (NPIs) occur in restricted environments, characterized by Ladusaw (1979) as downward entailing environments. These include the environments (47a-c), but not the hash-marked environments (47d-e), where the sentence is possible only with a generic interpretation. The alternatives generated by [any NP] are those obtained from sub-properties of the property contributed by the NP. For the case in (47), these are sub-properties of $\llbracket\text{cookie}\rrbracket$, for instance the property of being a square cookie, the property of being a poisonous cookie, and the property of being a non-square cookie. These alternatives propagate in the way described in this chapter. On the assumption that *any* is semantically an existential quantifier, (48a) is the ordinary semantics of the clause (47e). In addition we get the set of alternatives of the form described in (47b).

- (47)a. Justin didn’t eat any cookies.
 b. Nobody ate any cookies.
 c. Everyone who ate any cookies felt good.
 d. #Somebody ate any cookies.
 e. #Justin ate any cookies.

- (48)a. $\exists x.\text{cookie}(x) \wedge \text{eat}(\mathbf{j}, x)$
 b. $\exists x.Q(x) \wedge \text{eat}(\mathbf{j}, x)$, where Q is a sub-property of **cookie**.

The remaining part of the theory is a principle that restricts the distribution of NPIs by referring to alternative sets. For Krifka, this is a principle of *scalar assertion*, which says that all alternatives that are not entailed by the ordinary semantics are false. For (47e) this turns out to be a contradictory requirement, which is hypothesized to be responsible for the oddity of the sentence. If Justin ate some cookies, then either he ate some square cookies, or he ate some non-square cookies. So these two alternatives (neither of which is entailed by the ordinary semantics) could not both be false. On the other hand, looking at (47b), nobody eating cookies is perfectly compatible with nobody eating square cookies and nobody eating non-square cookies.²¹

These applications of alternative semantics are formally similar to alternative semantics for focus, in that they involve alternatives that are launched from specific positions, propagated compositionally, and then interpreted by certain op-

²¹Subsequent literature has suggested that the scalar exclusive operator is a phonetically null operator in the compositional structure, similar to *only* (Chierchia 2013).

erators. Currently there is not enough understanding of how these systems of alternatives relate to each other in the grammatical system. One issue is that disjunction and weak NPIs usually show default prosody or are de-stressed, so that it is difficult to analyze them as systematically involving focus of the prosodic kind.

References

- Aloni, Maria. 2003. Free choice in modal contexts. In *Sinn und bedeutung* 7, 28–37. University of Konstanz. Vol. 114 of *Arbeitspapiere des Fachbereichs Sprachwissenschaft*.
- Alonso-Ovalle, Luis. 2006. *Disjunction in Alternative Semantics*. GLSA, Dept. of Linguistics, South College, UMASS, Amherst MA 01003: University of Massachusetts, Amherst dissertation.
- Alonso-Ovalle, Luis. 2009. Counterfactuals, correlatives, and disjunction. *Linguistics and Philosophy* 32. 207–244.
- Beck, Sigrid. 2016. Focus sensitive operators. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Büring, Daniel. 1997. *The Meaning of Topic and Focus - the 59th Street Bridge Accent*. London: Routledge. Revised version of Tübingen doctoral dissertation.
- Büring, Daniel. 2003. On D-trees, beans, and B-accent. *Linguistics and Philosophy* 26(5). 511–545.
- Büring, Daniel. 2016. (Contrastive) topic. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Chereches, Anca. 2014. The pragmatics and prosody of focused some in a corpus of spontaneous speech. Manuscript, Cornell University.
- Chierchia, Gennaro. 2013. *Logic in Grammar: Polarity, Free Choice, and Intervention*. Oxford: Oxford University Press.
- Chomsky, Noam. 1971. Deep structure, surface structure, and semantic interpretation. In Danny Steinberg & Leon Jakobovits (eds.), *Semantics, an Interdisciplinary Reader*, 183–216. Cambridge: Cambridge University Press.
- Chomsky, Noam & Morris Halle. 1968. *The Sound Pattern of English*. New York: Harper and Row.

- Constant, Noah. 2012. Topic abstraction as the source for nested alternatives: A conservative semantics for contrastive topic. In *Wccfl 30*, 120–130. Cascadilla.
- Dretske, Fred. 1972. Contrastive statements. *Philosophical Review* 411–437.
- É. Kiss, Katalin. 2010. Structural focus and exhaustivity. In Malte Zimmermann & Caroline Fry (eds.), *Information Structure*, 64–88. Oxford: Oxford University Press.
- É. Kiss, Katalin. 2016. Discourse functions: The case of Hungarian. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Hamblin, C.L. 1973. Questions in Montague English. *Foundations of Language* 10(1). 41–53.
- Howell, Jonathan. 2011. *Meaning and Prosody: On the Web, in the Lab and from the Theorist's Armchair*: Cornell dissertation.
- Jackendoff, Ray. 1972. *Semantic Interpretation in Generative Grammar*. Cambridge, Massachusetts: MIT Press.
- Jacobs, Joachim. 1983. *Fokus und Skalen*. Tübingen: Niemeyer.
- Karttunen, Lauri. 1977. The syntax and semantics of questions. *Linguistics and Philosophy* 1. 3–44.
- Kratzer, Angelika. 1991. The representation of focus. In Arnim von Stechow & Dieter Wunderlich (eds.), *Semantik/Semantics: an International Handbook of Contemporary Research*, 804–825. Berlin: de Gruyter.
- Kratzer, Angelika & Junko Shimoyama. 2002. Indeterminate pronouns: the view from Japanese. In Yukio Otsu (ed.), *3rd Tokyo Conference on Psycholinguistics*, Hituzu.
- Krifka, Manfred. 1995. The semantics and pragmatics of polarity items. *Linguistic analysis* 25. 209–257.
- Ladusaw, William. 1979. *Negative Polarity as Inherent Scope Relations*: University of Texas, Austin dissertation.
- Lewis, David. 1973. *Counterfactuals*. Oxford: Blackwell.
- Liberman, Mark & Janet Pierrehumbert. 1984. Intonational invariance under changes in pitch range and length. In Mark Aronoff & Richard Oehrle (eds.), *Language Sound Structure*, 157–233. Cambridge, MA.: MIT Press.

- Myrberg, Sara & Tomas Riad. 2016. On the expression of focus in the metrical grid and in the prosodic hierarchy. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Paul, H. 1880. *Prinzipien der Sprachgeschichte*. Tübingen: Niemeyer.
- Pierrehumbert, Janet. 1980. *The Phonology and Phonetics of English Intonation*: MIT dissertation.
- Repp, Sophie. 2016. Contrast: Dissecting an elusive information-structural notion and its role in grammar. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Roberts, Craige. 2012. Information structure: Towards an integrated formal theory of pragmatics. *Semantics and Pragmatics* 5. 511–545. Originally circulated in 1998.
- Rochemont, Michael. 2016. Givenness. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Rooth, Mats. 1985. *Association with Focus*: University of Massachusetts dissertation.
- Rooth, Mats. 1992. A theory of focus interpretation. *Natural Language Semantics* 1(1). 75–116.
- Rooth, Mats. 1999. Association with focus or association with presupposition? In Peter Bosch & Rob van der Sandt (eds.), *Focus*, 232–244. Cambridge: Cambridge University Press.
- Rooth, Mats. 2005. Scope disambiguation by ellipsis and focus without scope economy. In Paul Dekker & Michael Franke (eds.), *Proceedings of the 15th Amsterdam Colloquium*, ILLC, University of Amsterdam.
- Rooth, Mats. 2015. Replication data for: Alternative semantics. [Dx.doi.org/10.7910/DVN/29158](https://dx.doi.org/10.7910/DVN/29158), Harvard Dataverse Network.
- Sæbø, Kjell Johan. 2016. The pragmatic functions of information structure. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Schwarzschild, Roger. 1999. GIVENness, avoidF and other constraints on the placement of focus. *Natural Language Semantics* 7(2). 141–177.
- Simons, Mandy. 2005. Dividing things up: the semantics of *or* and the modal *or* interaction. *Natural Language Semantics* 13. 271–316.

- Stalnaker, Robert. 1968. A theory of conditionals. In Nicholas Rescher (ed.), *Studies in Logical Theory*, 98–113. Oxford: Blackwell.
- von Stechow, Arnim. 1991. Focusing and backgrounding operators. In Werner Abraham (ed.), *Discourse Particles 6*, Amsterdam: Benjamins.
- Steedman, Mark. 2000. *The Syntactic Process*. MIT Press.
- Steedman, Mark. 2014. The surface-compositional semantics of english intonation. *Language* 90(1). 2–57.
- Truckenbrodt, Hubert. 1995. *Phonological Phrases—their Relation to Syntax, Focus, and Prominence*: MIT dissertation.
- Velleman, Leah & David Beaver. 2016. The pragmatic functions of information structure. In Caroline Fry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Wold, Dag. 1996. Long distance selective binding: The case of focus. In Teresa Galloway & Justin Spence (eds.), *Proceedings of SALT VI*, Ithaca, NY: CLC Publications.
- Yun, Jiwon. 2013. *Wh-indefinites: Meaning and prosody*: Cornell dissertation.