

Semantic Parameters and Universals

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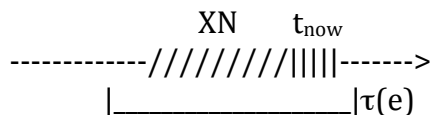
Abstract: This chapter investigates what kinds of semantic variation current theories of compositional variation lead us to expect. Examples of recent analyses of crosslinguistic variation in semantics are presented against this background. The result is a set of candidate parameters and candidate universals provided for further empirical testing.

Keywords: Semantic variation, semantic universals

1. Introduction

Languages vary in terms of interpretation. For example, it is not possible to assert in German the exact same proposition that English (1a) expresses - roughly, (1b). Southern German offers the possibilities in (2a,b), neither of which is identical to (1) (other German varieties have somewhat different options, none of which to my knowledge amount to (1); see Alexiadou, Rathert & von Stechow (2003), Beck & Gergel (2014)). The tense/aspect system of German does not offer the same possibilities as the English perfect and progressive.

- (1) a. Thilo has been writing a paper.
b. $\lambda t. \exists e [\tau(e) \supseteq XN_c(t) \ \& \ \text{Thilo_write_a_paper}(e)]$
"There is an event e of Thilo writing a paper whose run time $\tau(e)$ includes the relevant period of time reaching up to now."



- (2) a. Thilo hat ein Papier geschrieben.
Thilo has a paper written
'Thilo wrote a paper.'
b. Thilo schreibt ein Papier.
Thilo writes a paper
'Thilo writes/is writing a paper.'

The general question whether languages express the same meanings has been discussed in the literature under the key word of 'translatability' (see Katz (1976), Keenan (1974); also: 'effability'):

- (3) **Translatability:**
If a language L1 includes an acceptable sentence S expressing the proposition p, then any language L2 has a sentence that also expresses p.

An enlightening recent discussion of the issue can be found in von Stechow & Matthewson (2008), who point out that translatability has frequently been assumed to hold. There is good reason to think that it doesn't. Examples (1), (2) illustrate that languages vary in terms of the distinctions that their tense/aspect systems allow them to express; (Southern) German cannot be as specific as English. Conversely, we also encounter the situation that a language allows sentence interpretation to remain unspecified in some respect, where other languages require specific information (thanks to Walter Bisang (p.c.) for emphasizing this point). A case in point are languages that do not require expression of tense information in finite clauses, like Samoan (4) (Hohaus (2017)):

- (4) O lo'o siva le teine.
 TAM dance the girl
 'The girl {is/was/will be} dancing.'

We find such evidence against translatability not only in the domain of tense and aspect, but also for instance in the areas of modality and evidentiality; see Matthewson (2013) for a similar point and below for more discussion.

We also find that while possibly the same proposition gets expressed, the way this comes about by the structural and interpretive mechanisms available across languages varies considerably. To illustrate, I provide an example of universal quantification in English vs. Japanese from Shimoyama (2001, 2006). English (5) and Japanese (6) may give rise to the same truth conditions (see (6')). But while English uses the quantified determiner *every*, Japanese uses the particle *-mo* in combination with a so-called indeterminate phrase 'which student'. The ingredients for the composition of the sentence meaning are quite different as (5b) vs. (6b) indicate (see section 3.3 for an analysis).

- (5) a. Every student's mother danced.
 b. For all x , x a student: the mother of x danced.
- (6) a. dono gakusei-no okaasan-MO odotta.
 which student-Gen mother -MO danced
 b. For all alternatives y such that $y \in \{x\text{'s mother} \mid x \text{ a student}\}$:
 y danced
- (6') Suppose that the students are Linda, Julia and Saskia and their respective mothers are Lyn, Jenni and Sofia. Then both (5b) and (6b) are the proposition:
 λw .Lyn danced in w & Jenni danced in w & Sofia danced in w

Observationally, then, there is diversity both in what can be expressed and in how things can be expressed. The question pursued in this article is how this observed diversity is related to the grammar. How do the interpretive components of grammars vary, in other words, how is the grammar of language L1 different from the grammar of language L2 with regard to its interpretive components?

In opposition to the matter of variation, there has to be a substantial semantic core common to all human languages. Otherwise any attempt at translation would be doomed and linguists would never have entertained the translatability hypothesis (3) above. So we must

also ask what the limits of interpretive language variation are. This leads us to the question **Q1** which this article investigates.

Q1: Where do the grammars of human languages vary w.r.t. interpretation and where do they not?

There is by now a substantial amount of literature pertinent to this question. Von Stechow & Matthewson (2008) provide an extensive survey of work in semantics and typology. Their article can be seen as the most direct predecessor of this paper, reviewing the relevant literature and extracting the state of the art. Von Stechow & Matthewson's plot is to identify some successful universals in semantics. There are remarkably few. Two convincing nontrivial candidates are Function Application as a composition principle and conservativity (Barwise & Cooper (1981)) as a property of quantified determiner meanings (we come back to both below). In the course of searching for semantic universals, von Stechow & Matthewson naturally encounter claims regarding variation between languages. Those are significant. But they are not very systematic. It seems fair to say that they identify few (if any) clear examples of parametric variation in semantics. We have to conclude that the field has not yet developed a theory of semantic variation.

The approach I take in this paper is theory guided. I adopt a standard compositional semantic theory; that is, a theory of the interpretive components of the grammar. This theory identifies the modules or components we should think about in terms of possible variation. I then look for crosslinguistic phenomena and their analyses which target these modules. I end up suggesting the following view of semantic variation and universals:

(H) Variation per component hypothesis:
Each component of the grammar that contributes to compositional interpretation has a stable core and a variable part.

Our research question then becomes **Q2**:

Q2: Which part of each grammatical component is universal and which part is crosslinguistically variable?

I make some suggestions for first answers to this question. That is, I suggest, very tentatively, several possible universals and several possible parameters of semantic variation. These are advanced as an invitation for empirical testing. **(H)** is offered as a research strategy.

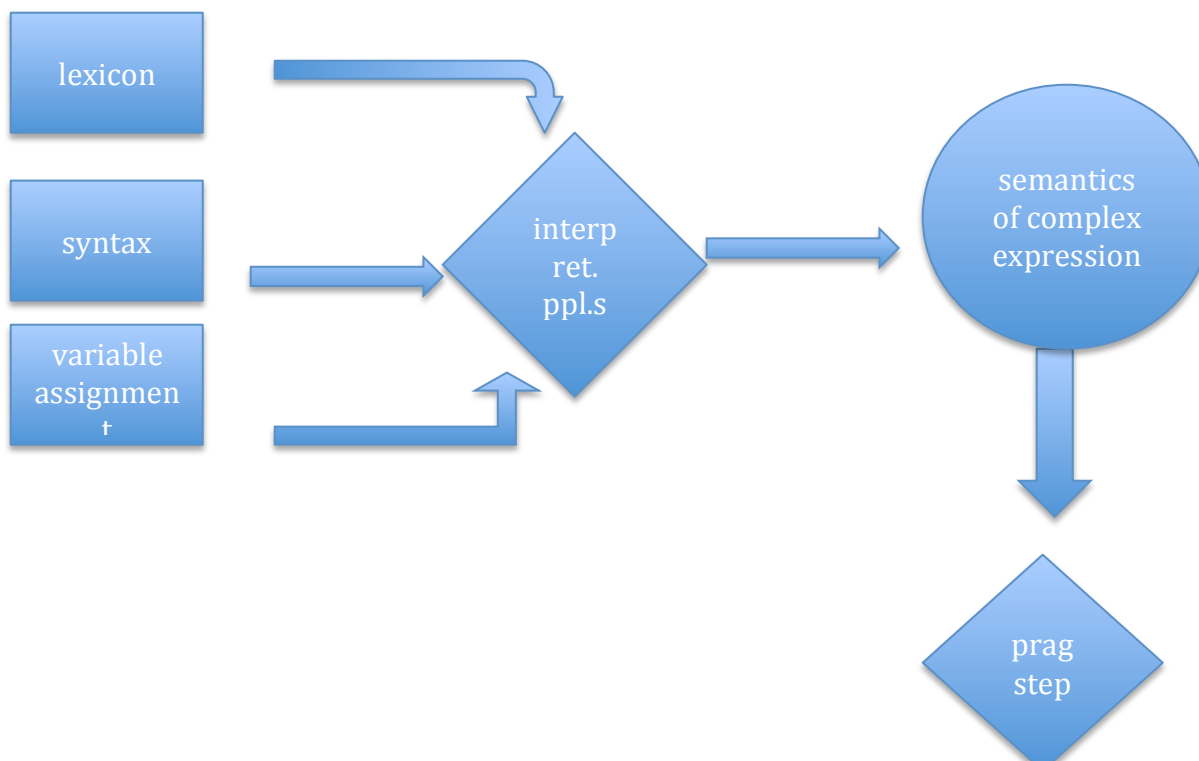
The structure of the paper is as follows: In section 2, I introduce the semantic theory I work with. On this basis, we can identify those ingredients to the theory that provide possible points of variation. Whether or not a given phenomenon attests variation in a particular component is clearly a matter of analysis: it is the analysis of the phenomenon that identifies the components of the grammar involved. Thus we have to gather information on the phenomenon **and** develop a compositional semantic analysis before we can think about possible points of language variation. I reject extreme positions regarding language variation and propose instead **(H)** above as a guideline for our research.

In section 3, I go over the interpretive components of the grammar and ask for each one whether or where there is plausible crosslinguistic variation. I discuss case studies pertaining to the various components - composition principles, the syntactic structure that is the input to composition, the lexicon, and the semantics/pragmatics interface. Each case study comes with a proposal as to where there is a parameter of crosslinguistic variation, but also a proposal as to where there is, very likely, no variation. I then point out some further possible example phenomena that target the same theoretical component. The overall picture I sketch motivates the hypothesis (**H**) above, and that is at the same time my conclusion, summarized in section 4.

2. Background

2.1. Semantic Theory Adopted

I assume a theory of compositional semantic interpretation that is by now fairly standard and exemplified by Heim & Kratzer (1998), McGonnel-Ginnet & Chierchia (2000), von Stechow & Heim (2010), Zimmermann & Sternefeld (2013) or Beck & Gergel (2014). I most closely follow Heim & Kratzer (1998). According to such a theory, the interpretation component as such consists of a set of general rules of compositional interpretation. The input to these rules are syntactic structures generated by the syntax component of the grammar - phrase structure trees. I assume that the input to interpretation are LFs (Logical Forms), which may differ from surface structures by virtue of movement transformations, deletions, reconstruction and the like. The lexicon is also input to the interpretation component proper and specifies meanings of those leaves in the tree that are not variables. Variables, finally, are leaves in the tree as well and interpreted by the variable assignment function. This function models context information: the context provides the salient values for free variables. Figure 1 represents this view of how the semantics of a complex linguistic expression is assigned. [Figure 1 near here]



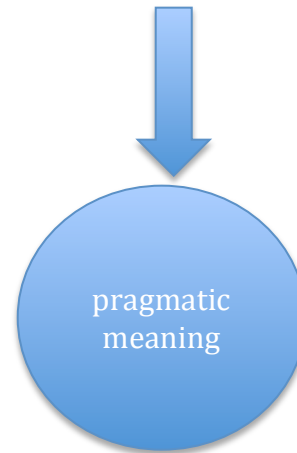


Figure 1: Interpretive system

Figure 1 contains one further component: I assume that uttering a linguistic structure comes with a pragmatic step. Most commonly this will be assertion. But there are other possibilities (see Krifka (2014) for a recent theory). And even when it is plain assertion, the pragmatic step needs to verify that presuppositions hold, potentially come up with an interpretation even when they don't and so on. The pragmatic step yields what we might call the pragmatic meaning or utterance meaning.

This type of theory of interpretation will be the basis of my reasoning in this paper.

2.2. Possible Points of Crosslinguistic Variation

Figure 1 identifies the components that participate in assigning an interpretation to a linguistic structure. Each of these components could in principle vary between languages. That is, we have the following potential for interpretive language variation:

- **syntax**: languages could differ w.r.t. the structures that are the input to compositional interpretation. One language might allow certain types of structures (e.g. derived by certain types of movements, or related to surface structures via certain types of deletion), while another does not. It is clear that languages differ in their (overt) syntax (see e.g. Haegeman (1991) for a starting point and Baker (2008) for an interesting recent discussion), for instance in the movements they employ or in their agreement patterns. Conceivably this is carried into LF syntax as well.

- **lexicon**: the interpretations assigned to basic expressions in the lexicon could vary between languages. We will be interested in two ways in which this could occur in particular: (i) the functional lexicon might vary. For example a language might have a lexical item with the content of English *the* while another language does not; (ii) there could be systematic lexical variation in the sense that, say, nouns in one language have a certain

semantic type while they have another type in another language. (We ignore matters of lexical variation in the domain of content words. See von Stechow & Matthewson (2008) for discussion.)

- **variables**: a language could have certain variables that another lacks (e.g. a certain semantic type, or a bound variable of a certain kind).

- the **interpretation component** proper: the set of composition principles available could vary from language to language.

- the **pragmatic step**: the inventory and/or content of the operations that realize the pragmatic step could vary between languages.

The first and the last of these components would not generally be considered part of semantics, but they are so intimately tied up with the rest that it makes more sense to include them in the discussion than to try to disentangle them (see section 2.4. for an example).

2.3. Constraining the answer space

Here is a refined formulation of the question **Q1** (where 'the interpretive components' are intended to be the ones listed above):

Q1': Where do the interpretive components of the grammars of human languages vary and where do they not?

As indicated in the introduction, I will not entertain the possibility that there is no semantic variation. I will not entertain either the possibility that there are no constraints on language variation, that is, that any interpretive step could vary. It is generally taken for granted that this can't be right. It seems unlikely that languages vary randomly in terms of the compositional options they have. For example, it would be unexpected to find a language that employs a rule parallel to Predicate Modification but yielding the disjunction (union) of the two daughters instead of their conjunction (intersection), as illustrated in (7).

- (7)
- a. blue house
 - b. If $X=[Y Z]$ and both Y and Z are of type $\langle e,t \rangle$ then $[[X]] = \lambda x. [[Y]](x) \text{ or } [[Z]](x)$
 - c. $[\lambda x. x \text{ is a house or } x \text{ is blue}]$

Even more uncontroversial is the view that in all languages the argument slots of a function expression can be filled with a suitable argument. In the Heim & Kratzer theory, this corresponds to the principle Function Application (FA) (Chung & Ladusaw (2004) call this mode of composition 'saturation').

Let me also explicitly reject a hypothesis that has enjoyed a certain popularity: the idea that variation is limited to the lexicon (in syntax it is known as the Borer-Chomsky conjecture, see Borer (1983); also Baker (2008)). This hypothesis, when applied to semantics, neglects the fact that a decision on the lexical input frequently has repercussions for other

compositional ingredients. For example, the analysis of Japanese *-mo* above requires a set of composition rules for alternative semantic values (see section 3.3. for details). If we didn't have operators like *-mo*, we would not need those rules. The components in 2.1. are tied together very closely. The LF structures generated must match the interpretation principles available. A functional element needs to be able to occur in a compositional context with which it can combine. We will see several such ties below.

Further relevant examples, in which lexical variation is not the most plausible analysis, are given in the case studies below. I will not pursue the hypothesis that semantic variation is limited to the lexicon.

If language variation in semantics exists, is not wild, and is not limited to the lexicon, what would be an interesting hypothesis about semantic variation to explore?

2.4. The Role of Analysis and a Research Hypothesis

Any concrete hypothesis about variation can only be explored on the basis of analysis. Observation of a phenomenon is compatible with a bunch of analyses which may well differ in terms of what the locus of crosslinguistic variation would be. Suppose that in language L, we find that bare nouns like *dog*, *house* and so on can have an interpretation equivalent to English definite descriptions 'the dog', 'the house'. Let's assume the Fregean semantics for definite descriptions from Heim & Kratzer (1998). Here are three ways in which we could account for the interpretive possibility in L:

- (8) interpretation principle:
 If $X = [{}_Y N]$ then for any g : $[[X]]^g$ is only defined if there is a unique z such that $[[N]]^g(z) = 1$. Then, $[[X]]^g =$ the unique z such that $[[N]]^g(z) = 1$
- (9) covert functional morpheme:
 The structure is $[NP \emptyset_{\text{Det}} N]$ and $[[\emptyset_{\text{Det}}]] =$
 $[\lambda f$: there is a unique z such that $f(z) = 1$. the unique z such that $f(z) = 1]$
- (10) type shift (option for systematic extension of the lexicon):
 If a noun X has the meaning $[[X]]$ then, if there is a unique z such that $[[X]](z) = 1$, it also has the meaning: the unique z such that $[[X]](z) = 1$

Note that different components are responsible in each possible analysis - the interpretation component proper in (8), (LF) syntax in (9), and the lexicon in (10). Which possibility we would prefer would depend on further facts about the language L. For example, is it plausible that there is a phonologically empty determiner in the structure?

Generally, the three strategies (i) composition principle, (ii) empty operator in the LF, and (iii) type shifting, are interchangeable in terms of the semantic result they yield (a reason, note, to include LF in the discussion of semantic variation).

Thus any hypothesis about variation concretely put forward is based on the compositional semantic analyses available. (See also Matthewson (2013) for discussion of the importance of analysis to discover and locate language variation.) The phenomena and analyses that I am familiar with lead me to hypothesis (**H**):

(H) Variation per component hypothesis:
Each component of the grammar that contributes to compositional interpretation has a stable core and a variable part.

To give one example illustrating **(H)** as a preview of section 3: the composition principles Function Application and Predicate Abstraction are strong candidates for universal principles (core of the 'composition principles' component). Availability of the principle that allows interpretation of resultatives ('Sally hammered the metal flat') ('Principle R' below) is very likely subject to crosslinguistic variation (i.e. a variable part of the same component).

If **(H)** is right, our research question becomes **Q2**, as anticipated:

Q2: Which part of each grammatical component is universal and which part is crosslinguistically variable?

I explain my position in section 3 below by providing plausible instances of semantic variation with their analyses which together motivate **(H)**.

3. Crosslinguistic Variation and Nonvariation: what we have found so far

In this section, I go over the components of the grammar that contribute to interpretation one by one. In each case, I examine a crosslinguistically variable phenomenon and a possible point of variation in the analysis to account for it. That is, I pick examples - I do not try to provide an exhaustive discussion. I supplement the example with some suggestions as to aspects of the same grammatical component that are not variable, as well as some hints as to further candidates for parametric variation in that component. By **parameter** I mean a decision point in the grammar that has consequences for a set of data types together (see Snyder (2007)).

It should be kept in mind that our state of knowledge in crosslinguistic semantics is still very limited. I think of the possible parameters and universals discussed below as tentative hypotheses to be tested against further empirical research, rather than as anything like a well-founded theory. In some cases, I don't even make a tentative proposal but phrase the issue as a question.

I also need to note that the selection of phenomena is strongly biased by what I am familiar with from my own work. This is simply because I understand those phenomena best and hence feel most confident about their analyses. I try to balance the view by referring to further, theoretically similar phenomena from the literature in the discussion. The reader is also referred to von Stechow & Matthewson (2008) for discussion of other crosslinguistically interesting phenomena.

3.1. Case Study I: Composition Principles

3.1.1. Data: resultative constructions across languages

It is well known (e.g. Green (1973), Levin and Rapoport (1988), Aske (1989), Talmy (1991), Snyder (2001)) that resultatives like (11) exist in many languages (e.g. English, German, Hungarian, Korean, Mandarin etc.) but not in Spanish (12), French, Hebrew, Hindi and others.

- (11) a. Sonja painted the door pink.
 b. Mary hammered the metal flat.
 c. Nadine laughed herself helpless.

- (12) Mary golpeó el metal (*plano).
 Mary beat the metal (*flat).
 'Mary beat the metal flat.'

Based on crosslinguistic as well as acquisition data, Snyder (1995), (2001) argues that this reflects a grammatical parameter. In addition to availability of resultatives, Snyder's parameter covers availability and/or interpretation of verb-particle constructions, double object constructions, goal PP constructions and others.

- (13) Complex Predicate Parameter (Snyder (2001)):
 One grammatical parameter is responsible for the availability of complex predicate constructions (resultatives, verb-particle constructions and others).

3.1.2. Analysis

Following Beck & Snyder (2001) and Beck (2005), I assume that at the heart of Snyder's parameter lies the availability of an interpretation principle going back to von Stechow (1995):

- (14) Principle (R) (Stechow (1995)):
 If $\alpha = [V\gamma SC\beta]$ and $[[\beta]]$ is of type $\langle v, t \rangle$ and $[[\gamma]]$ is of type $\langle e, \dots \langle e, \langle v, t \rangle \rangle \rangle$
 (an n-place predicate), then
 $[[\alpha]] = \lambda x_1 \dots \lambda x_n \lambda e. [[\gamma]](x_1) \dots (x_n)(e) \ \& \ \exists e' [BECOME(e')([[\beta]]) \ \& \ CAUSE(e')(e)]$

The principle is designed for the interpretation of resultatives. Below I illustrate how the principle applies in the compositional interpretation of example (11b). The structure is a direct combination of a transitive verb with a small clause SC denoting a property of events $\langle v, t \rangle$. The small clause has a PRO subject which is bound by 'the metal' in (16).

- (15) $[[[V' \text{hammered} [SC \text{PRO}_1 \text{flat}]]]] =$
 $\lambda x. \lambda y. \lambda e. \text{hammer}(x)(y)(e) \ \& \ \exists e' [BECOME(e')(\lambda e'' . \text{flat}(z_1)(e'')) \ \& \ CAUSE(e')(e)]$

- (16) $[[[[[\text{the metal}] [[VP \text{Mary} [V' t_1 [V' \text{hammered} [SC \text{PRO}_1 \text{flat}]]]]]]]]] =$
 $\lambda e. \text{hammer}(\text{the_metal})(M)(e) \ \& \ \exists e' [BECOME(e')(\lambda e'' . \text{flat}(\text{the_metal})(e'')) \ \& \ CAUSE(e')(e)]$
 "Mary's hammering the metal caused it to become flat."

Note that the combination of the transitive verb *hammer* and the property of events expressed by the small clause 'PRO₁ flat' is a type mismatch in a semantics without Principle (R): the structure in (15) would be uninterpretable. This would occur in all those languages that lack Principle (R), leading to unacceptability of resultatives. In languages with Principle (R), resultative structures are interpretable and acceptable. The principle is available for the interpretation of further constructions identified by Snyder as being governed by his parameter. See Beck & Snyder (2001), Beck & Johnson (2004), Beck (2005) for further discussion. It is interesting that Principle (R) applies in a domain which is borderline between syntax and morphology (Snyder (2001)): Snyder ties the complex predicate parameter to productive root compounding. Perhaps variation is more easily possible in an interface area such as the interface between morphology and syntax.

3.1.3. Summary and Outlook

The proposed semantic parameter (17), Principle (R), concerns a rule of compositional interpretation. It is part of the interpretation component proper (see Figure 1). How plausible is it that the interpretation principles are subject to variation?

- (17) **(R) parameter:**
A language {does/does not} have Principle (R).

I suggest, with von Stechow & Matthewson and probably many others, that certain principles are **universal**. In addition to Function Application FA, I want to consider in particular Predicate Abstraction PA (18a). PA permits the creation of predicates in the syntax. Predicates being the arguments that quantifiers need, PA is also what allows proper syntactic quantification (18b) (as opposed to lexical quantification (18c)). See also the next subsection for LF structures that feed PA.

- (18) a. Predicate Abstraction PA:
If $X = [i Y]$ then for any g : $[[X]]^g = \lambda z. [[Y]]^{g[z/i]}$
- b. Someone lost his hat. (syntactic quantification)
[someone [1[t₁ lost his₁ hat]]]
 $\exists x[x \text{ lost } x\text{'s hat}]$
- c. Vera ate. (lexical quantification)
[[eat]] = $\lambda x. \exists y[x \text{ eat } y]$
 $\exists y[\text{Vera ate } y]$

On the other hand, I suggest that there may be further cases of crosslinguistic **variation** similar to the (R) parameter. A candidate is productive noun incorporation, illustrated in (19) for West Greenlandic (from van Geenhoven (1996)):

- (19) Arnajaraq eqalut-tur-p-u-q.
Arnajaraq.Abs salmon-eat-Ind-[-tr]-3sg
'Arnajaraq ate salmon.' / Lit: 'Arnajaraq salmon-ate.'

Below is a principle that would allow us to interpret such structures, and the interpretation of the example (see van Geenhoven (1996) for a semantic analysis along these lines). I refer the reader to Bittner (1994), van Geenhoven (1996), Chung & Ladusaw (2004), and also von Stechow and Matthewson for relevant discussion.

(20) Incorporation (following van Geenhoven (1996)):
 If $\alpha = [N\gamma \vee \beta]$ and $[[\gamma]]$ is of type $\langle e, \langle s, t \rangle \rangle$ and $[[\beta]]$ is of type $\langle e, \langle e, \langle s, t \rangle \rangle \rangle$, then
 $[[\alpha]] = \lambda x. \lambda w. \exists y [[[\gamma]](y) \& [[\beta]](y)(x)(w)]$

(21) a. $[[\text{eqalut-tur}]] = \lambda x. \lambda w. \exists y [\text{salmon}(y) \& \text{eat}(y)(x)(w)]$
 b. $[[\text{Arnajaraq eqalut-tur-p-u-q}]] = \lambda w. \exists y [\text{salmon}(y) \& \text{eat}(y)(A)(w)]$

In sum, I conjecture that a core set of composition rules is universally available while certain other rules (which perhaps apply under restricted circumstances) may or may not be available in a given language. With resultatives and noun incorporation, we have seen two potential examples of variation, and with FA and PA, candidates for universal principles of composition.

3.2. Case Study II: The Syntax of Logical Form

3.2.1. Data: Sequence of tense across languages

Languages vary with regard to the tense forms of verbs used in embedded clauses to convey certain interpretations (see e.g. Grønn & von Stechow (2010, 2011), von Stechow (2009), Ogihara (1996), among many others). For example, in English complement clauses a past tense verb form can be used to express a reading in which the eventuality described in the embedded clause takes place at the same time as the eventuality described in the past tense matrix clause:

(22) a. Anna thought that Konstantin was happy.
 At 9pm yesterday, Anna thinks: "Konstantin is happy now."
 simultaneous: Anna thinking and Konstantin being happy occur at the same time, 9pm yesterday.
 b. He said that he was living in Moscow.
 simultaneous: his living in Moscow is at the same time as his utterance.

English uses a "past under past" structure to express a simultaneous interpretation. A parallel interpretation in Russian, on the other hand, is obtained by a "present under past" structure (examples from Grønn & von Stechow, my glosses):

(23) a. On skazal, čto živet pod Moskvoj.
 he say.past that live.pres in Moscow
 'He said that he was living in Moscow.'
 b. On znal, čto ona stoit u okna.
 he know.past that she stand.pres there
 'He knew that she was standing there.'

A "past under past" structure is possible in Russian. It conveys a backward shifted interpretation; that is, the eventuality described in the embedded clause precedes the eventuality described in the matrix clause (examples also from Grønn & von Stechow).

- (24) a. Kucharka sčitala, čto lensman ne požalel porochu.
 cook remark.past that sheriff not spare.past powder
 'The cook remarked that the sheriff obviously had not spared gunpowder when he fired his cannon.'
- b. No rodnye znali, čto on sdal svoj poslednij ékzamen.
 But know.past that he take.past his final exam
 'But they know he had taken his final examinations at last.'

What seems to vary between English and Russian (and other languages) is whether or not the embedded past tense verb form corresponds to its own semantic shift to the past (Russian) or not (English). (The English structures have other interpretations in addition to the simultaneous reading discussed here. What matters for our purposes is that English has the simultaneous reading and the parallel Russian structure does not.)

3.2.2. Analysis

Grønn & von Stechow (2010) propose a Sequence of Tense parameter (see also Article 116: Sequence of Tense). The parameter divides languages into Sequence of Tense languages on the one hand and non-Sequence of Tense languages on the other. Simplifying greatly, I report their parameter here as follows:

(25) **Sequence of Tense parameter:**

A past tense verb form {is/is not} licensed by a superordinate PAST operator.

Grønn & von Stechow implement this parameter in terms of agreement: a verb from has to find an operator in a proper relationship that it agrees with. Let us look at the Logical Forms and interpretations (26) - (28) to see the parameter at work (I remain silent here on whether the difference between the English and the Russian exists before LF; what matters is that it exists at LF.). (26) is the English LF (let's suppose that "he" refers to Victor).

- (26) $[\lambda t [\text{PAST } t [\lambda t' [\text{he say-past } t' [\text{CP } \lambda t'' [\text{he be-past living in Moscow } t'']]]]]]$ licensed

$\lambda t. \exists t' [t' < t \ \& \ \text{say}(t')(\lambda t''. \text{live_in_Moscow}(t'')(Victor))](Victor)$
 "there is a time t' before now such that Victor makes a claim at t', and
 if that claim is correct then Victor lives in Moscow at t'."

- (27) $[[\text{PAST}]] = \lambda t. \lambda p < i, t >. \exists t' [t' < t \ \& \ p(t')]$

The analysis (like others before it) relies on an indirect relationship between verbal morphology and temporal operators. It is not the verbal morphology that expresses a temporal shift but an abstract operator PAST. But the morphology has to be licensed by a c-

Let's zoom out again to the topic of this subsection. Looking beyond tense, and concentrating on properties of LF instead, what could be **universal** properties of LF? I suggest that the following hypothesis would be a candidate:

- (30) All languages have LFs that feed Predicate Abstraction PA.
 [1[...x₁...]]

That a language has this property and the corresponding principle PA would be required and verified by many data points. We have just seen one type of data with temporal operators, for variables of and abstraction over type <i> (Grønn & von Stechow (2010) and many others). Another obvious case is movement structures that are represented at LF and get interpreted, for example Quantifier Raising QR, for type <e> (e.g. Heim & Kratzer and references therein). Further pertinent types of data include modals (Iatridou & Zijlstra (2010, 2012)) for type <s>; aspect (Hacquard (2006)) for type <v> of events; plural predication (Roberts (1987), Beck (2012b), a.o.) for type <e>. If a language has at least one of them, (30) is supported. This universal together with PA would allow for syntactic quantification over various semantic types.

Let us also ask if there are further cases of crosslinguistic **variation** that are theoretically similar to sequence of tense. Where else do languages plausibly vary w.r.t. to the LF structures they make available? Two movement operations come to mind as fairly obvious candidates for variability: QR and wh-movement. As for the first, it is well known that in English, sentences with two quantified NPs are frequently ambiguous, allowing in particular an inverse scope interpretation: the quantifier that is syntactically lower takes wide scope in the interpretation. This is analysed with the help of the LF movement QR (May (1985)). (31) illustrates.

- (31) a. Some girl caught every boy. (ambiguous)
 b. ok: For every boy x, there is a girl who caught x.
 c. LF: [[every boy] [1 [some girl caught t₁]]]

While the sentence is ambiguous in English, it has frequently been claimed to lack the inverse scope reading in other languages (see for example Aoun & Li (1993), Huang (1995), Skontras et al. (2013), Han et al. (2008), Bobaljik & Wurmbrand (2012)). The example in (32) is from Han et al. (2008). The lack of ambiguity suggests that QR is not able to create the counterpart of (31c) as a possible LF for Japanese (32). This kind of variation is not particularly surprising in view of the fact that overt syntactic movement operations are also known to be, to some extent, variable between languages (see e.g. Haegeman (1991) for a starting point).

- | | | | | |
|------|-------------------------------|-----------|----------------------------------|--------------|
| (32) | Dareka on'nanoko-ga | otokonoko | daremo-o | tsukamae-ta. |
| | some girl-Nom | boy | every-Acc | catch-Past |
| | 'Some girl caught every boy.' | | (wide scope of 'some girl' only) | |

Similarly, for wh-phrases in situ analyses have been entertained that move them vs. leave them in situ at LF. Pesetsky (2000) (a.m.o. - see references in Pesetsky (2000)) argues that wh-in-situ in English moves at LF. The LF of (33a) is thus (33c). One argument for this

movement is the superiority effect in (33d) which is analysed as a constraint on movement: the higher wh-phrase has to move overtly. (33d) violates this constraint.

- (33) a. Who bought what?
b. For which x,y : x bought y ?
c. LF: [who [1[what [2[t_1 bought t_2]]]]]
d. * What did who buy?

Superiority effects are not equally present in all languages. Languages that lack them and other indicators of movement might not make available the LF corresponding to (33c), that is, they might not employ LF wh-movement. See for example Pesetsky (2000), Cable (2010) for discussion. I cannot do the issue of LF movement justice here. I merely note that a large research tradition claims that languages differ with respect to which LF structures certain surface structures can be related to. See the literature cited for details.

In sum, I conjecture that the LFs that are the input to compositional interpretation, like the interpretation principles themselves, have a large crosslinguistically stable common core. Beyond those properties that the syntax component of the grammar would suggest are universal (this might be things like e.g. binary branching trees), there could be somewhat less obvious aspects like variable binding structures [1[... x_1 ...]]. The crosslinguistic variation that we observe in overt syntax - regarding for instance movement operations and agreement patterns - plausibly continues into the level of LF.

3.3. Case Studies IIIa and IIIb: The Lexicon - functional lexical items and systematic lexical variation

3.3.1. The functional lexicon: quantification over alternatives

This subsection investigates variability in the functional lexicon. The functional element that I mainly consider is the Japanese particle *-mo*. I follow Shimoyama's (2001, 2006) analysis according to which it is a universal quantifier over alternatives (see also Yatsushiro (2009), Uegaki (2018)). Let us look at the analysis of example (34) from the introduction in more detail.

- (34) a. [[dono gakusei-no] okaasan]-MO odotta.
which student-Gen mother -MO danced
b. For all alternatives y such that $y \in \{x\text{'s mother} \mid x \text{ a student}\}$: y danced

Shimoyama analyses the indeterminate phrase 'dono gakusei' as introducing alternatives, following Hamblin (1973). This is motivated by the fact that it occurs as a wh-phrase in wh-questions, and wh-questions are analysed by Hamblin in terms of an alternative semantics. The denotation of the indeterminate phrase, accordingly, is a set of individuals (35a). Such alternatives are passed on compositionally as we build up denotations for larger constituents, (35b).

- (35) a. [[dono gakusei]]_{Alt} = { x : x is a student}
e.g. {Linda, Julia, Saskia}

- b. $[[[\text{dono gakusei}]\text{-no okaasan}]]_{\text{Alt}} = \{ x\text{'s mother} \mid x \text{ is a student} \}$
 e.g. $\{ \text{Linda's mother, Julia's mother, Saskia's mother} \}$

This means that in addition to compositionally calculating ordinary semantic values $[[\cdot]]_o$, we calculate a second tier of meaning, alternative semantic values $[[\cdot]]_{\text{Alt}}$ (see Hamblin (1973), Rooth (1985, 1992), and for a recent implementation Beck (2016)). We assume the version in (36) of Function Application which also calculates alternative semantic values. The second clause allows us to combine the meaning of *okaasan* 'mother' with 'dono gakusei' in a pointwise fashion, yielding (35b) above as desired, (37).

(36) Function Application (FA):

If α is a binary branching tree with daughters β and γ , then for any g :

$$[[[\beta \ \gamma]]]_{o^g} = [[[\beta]]]_{o^g} ([[[\gamma]]]_{o^g})$$

$$[[[\beta \ \gamma]]]_{\text{Alt}^g} = \{ \beta'(\gamma') : \beta' \in [[[\beta]]]_{\text{Alt}^g} \text{ and } \gamma' \in [[[\gamma]]]_{\text{Alt}^g} \}$$

- (37) $[[[\text{dono gakusei}\text{-no okaasan}]]]_{\text{Alt}} = \{ \beta'(\gamma') : \beta' \in [[[\text{okaasan}]]]_{\text{Alt}^g} \ \& \ \gamma' \in [[[\text{dono gakusei}]]]_{\text{Alt}^g} \}$
 $= \{ \beta'(\gamma') : \beta' = [[[\text{okaasan}]]]_{o^g} \ \& \ \gamma' \in \{x : x \text{ is a student}\} \}$
 $= \{ x\text{'s mother} \mid x \text{ is a student} \}$

Note that the result is an alternative semantic value, a set of alternatives. Certain operators in natural language evaluate alternatives, and this is Shimoyama's analysis of *-mo*. In (38) below is the composition principle that interprets structures with *-mo*. The truth conditions of the example are calculated in (39).

- (38) If $Z = [XP \text{-}MO]$ then $[[[Z]]]_{o^g} = \lambda P. \forall x \in [[[XP]]]_{\text{Alt}^g} : P(x)=1$

- (39) a. $[[[[\text{which student's mother}] \text{-}MO]]]_{o^g}$
 $= \lambda P. \forall x \in \{ \text{Linda's mother, Julia's mother, Saskia's mother} \} : P(x)=1$
 b. $[[[[\text{which student's mother}] \text{-}MO \text{ danced}]]]_{o^g}$
 $= 1 \text{ iff } \forall x \in \{ \text{Linda's mother, Julia's mother, Saskia's mother} \} : x \text{ danced}$

It is not standardly assumed that English and related languages have an element like *-mo*. Universal quantification by Present Day English *every*, *say*, is effected at the level of ordinary semantic values. Thus a language may or may not have a lexical element with this meaning. This is a fairly interesting case of variation in the functional lexicon because in the analysis with ordinary and alternative semantic values, an operator like *-mo* requires its own interpretation principle relating ordinary and alternative semantics. The existence of the lexical item requires the addition of (38) to the interpretation component.

We can carry the investigation of crosslinguistic variation in the area of alternative semantics a little further and ask the following questions: Do all languages make use of a tier of alternative semantic values? And to what extent are the constructions that use an alternative semantics crosslinguistically stable/variable?

Regarding the first question, alternative semantic values were motivated by Rooth for English focus in particular. Zimmermann & Onea (2011) propose that alternative semantics is in fact universal. This relates to the second question, too: the semantics of focus is a

plausible candidate to have an alternative semantics universally. On the other hand, the example of universal quantification by Japanese *-mo* vs. English *every* indicates that there is some variation regarding which constructions use an alternative semantics (see e.g. Haspelmath (1995) for universal quantification crosslinguistically and diachronically). Further constructions which have been argued to involve an alternative semantics in English include questions (Hamblin (1973)) and disjunction (von Stechow (1991)), and for each case we can ask if this is so in all languages. See Howell (2018) for discussion.

Moving away from alternative semantics in particular, and returning to the general issue of crosslinguistic **variation** in the functional lexicon: what other cases of variation concerning functional lexical items have been discovered in semantics? I give two examples of further interesting areas below:

(i) the inventory of tense and aspect heads

We have seen in the introduction that English has Perfect and Progressive, which (Southern) German lacks ((1),(2)). Tense/Aspect systems are known to vary across languages, see for example Cable (2013) for Kikuyu, Terry (2004) for African American English, and the references in section 3.2. For recent discussion of crosslinguistic variation in the domain of tense, see Bittner (2014), Mucha (2016), Tonhauser (2015). (Note that this area generally challenges translatability, as anticipated in the introduction.)

The discussion could be extended to other functional categories in the clausal architecture like mood or evidentiality. Languages seem to vary in terms of which of these (universal?) categories they express. See sections 3.4. and 3.5 for related discussion.

(ii) comparison operators

Bhatt & Takahashi (2011) argue that Hindi makes use of a comparative operator 'more' that English does not use (from Heim (1985); see also Kennedy (1997, 2007), Beck et al. (2012)). An example is given in (40a) (LF in (40c), the operator in (40b) and truth conditions in (40d)). This example has an interesting consequence for the grammar: Bhatt & Takahashi's Hindi operator requires parasitic movement - particular LF structures that feed on a prior movement operation as in (40e) (Sauerland (1998)). The existence of the functional lexical item thus has consequences for LF syntax. We see once more that the various components that contribute to compositional interpretation go hand in hand. A claim about existence of a functional element with a certain semantics does not stand alone (a point also made e.g. in Gergel (2010)).

- (40) a. John Bill-se zyaadaa lambaa hai.
 John Bill-than more tall is
 'John is taller than Bill.'
- b. [[zyaadaa/more]] = $\lambda y.\lambda R.\lambda x.\max(\lambda d.R(d)(x)) > \max(\lambda d.R(d)(y))$
- c. [John [[Bill-than more] [1[2[t₂ is t₁-tall]]]]]
- d. $\max(\lambda d.\text{John is } d\text{-tall}) > \max(\lambda d.\text{Bill is } d\text{-tall})$
 'John's maximal degree of tallness exceeds Bill's maximal degree of tallness.'
- e. Parasitic movement:
 [X [Y [2[1[... t₁ ... t₂ ...]]]]]

It is fairly clear, then, that the lexical inventory, including the functional lexicon, varies between languages. There are still interesting questions to be asked about **universals** on a more abstract level, however. For example: is there a universal set of semantic building blocks that is distributed differently over lexical items by the languages of the world? Von Stechow & Matthewson speculate that this may be so for aspect, and possibly also for modality. Von Stechow & Matthewson, following Partee (1992), also discuss whether there is a universal inventory of possible functional meanings. One area in which this question can be asked is determiner or quantifier meanings. Let us take the traditional view that quantified determiners denote relations between sets. Of all the logically possible relations between sets, human languages seem to use only a small subset. One constraint on this subset is Barwise & Cooper's (1981) famous concept of conservativity (their 'lives on' property).

(41) A quantified determiner X is conservative iff for all A, B :
 $[[X]](A)(B) = 1$ iff $[[X]](A)(A \cap B) = 1$

Conservativity is a strong universal constraint on possible quantified determiner meanings. It can be reexamined from the perspective of a universal inventory of building blocks for function words.

Von Stechow & Matthewson further discuss Barwise & Cooper's suggested universal that all languages have determiners that express relations between sets. They take this to be falsified by crosslinguistic research on quantification. But they entertain the alternative hypothesis that all languages have quantification. I suggest to relate this to the proposed universal above that all languages have PA and LFs that feed PA.

To sum up, languages vary in their functional lexicon. This has important consequences for the other components that contribute to composition (LF, composition principles etc.). Semanticists have begun to explore possible generalizations across the functional lexicon that hold despite the obvious variation observable. (I speculate that the concept of a parameter might become useful in the discussion of variation in the functional lexicon when such generalizations are available).

3.3.2. Systematic lexical variation: gradable predicates

Let's turn to systematic lexical variation next. The expression of comparison constructions is crosslinguistically highly variable. Stassen (1985) gives a well-known typological overview and Beck et al. (2009) suggest a series of three dependent parameters of variation to account for the clusters of properties that we find. I focus here on the most fundamental of Beck et al.'s parameters, the Degree Semantics Parameter DSP:

(42) **Degree Semantics Parameter DSP:**
A language {does/does not} have gradable predicates (type $\langle d, \langle e, t \rangle \rangle$ and related).

If a language has the positive setting of this parameter, the language has degree predicates and the first basic ingredient for degree constructions. English would be an example that is standardly so analysed (as well as Dutch, German, Hindi, Japanese and others - see Beck et al. for details). For illustration, see the lexical entry for a gradable adjective in (43). If a

language has the negative setting of the DSP, its adjectives (or, more generally, its predicates) do not have a degree argument slot. A lexical entry for Motu 'tall', an example of a language that is analysed as [-DSP], is given in (44).

(43) $[[\text{tall}_{\text{English}}]] = \lambda d. \lambda x. \text{Height}(x) \geq d = \lambda d. \lambda x. x \text{ is } d\text{-high}$ type $\langle d, \langle e, t \rangle \rangle$

(44) $[[\text{tall}_{\text{Motu}}]]^c = \lambda x. x \text{ counts as tall in } c$ type $\langle e, t \rangle$

Clearly, the proposed parameter is a case of systematic lexical variation: a whole class of expressions has a systematically different type of lexical entry in Motu than in English. What are the empirical consequences of the negative setting of the DSP?

Basically, all those constructions that motivate the assumption of a grammar of degree in English are not available in Motu: comparatives, superlatives, intensional comparisons with 'too' and 'enough', measure constructions, degree questions and so on. Motu offers what we may call pragmatic paraphrases: similar information is conveyed by different grammatical means. I provide (45) for illustration. (46) and (47) show that Motu does not combine degree denoting expressions like '1.80m', '10cm' with predicates like 'tall'. The latter fact in particular motivates the assumption that predicates like *lata* 'tall' have no degree argument slot in this language.

(45) Maria na lata to Frank na kwadogi.
 Maria is tall but Frank is short
 'Mary is taller than Frank.' / lit.: 'Mary is tall but Frank is short.'

(46) * Maria na 1.80m lata.
 Maria is 1.80m tall
 intended: 'Mary is 1.80m tall.' (comparison to a degree)

(47) * Maria na 10cm lata to Frank na kwadogi.
 Maria is 10cm tall but Frank is short.
 intended: 'Mary is 10cm taller than Frank.' (differential comparative)

Thus the setting of the DSP has far reaching consequences for the grammar of comparison in a given language. For example, if the language never introduces degrees at all, it cannot have degree operators like the comparative (e.g. (40b)), which relates two degrees.

Hohaus, Tiemann & Beck (2014) provide further support for Beck et al.'s parametric analysis from child language acquisition. Bochnak (2013, 2015) argues that Washo is also a [-DSP] language (his data are less detailed than the series of studies summarized in Beck et al. in that important negative evidence including the data corresponding to (46) and (47) is not available; he adds data points on norm-relatedness and crisp judgements (Kennedy (2007))). Bowler (2016) and Deal & Hohaus (2018) report that Warlpiri and Nez Perce, respectively, are [-DSP] as well.

Back to the general issue of systematic lexical variation. If the above analysis is correct, then the types available for the lexicon differ from language to language. But in this area, as well, we would expect to find **universals**. For example, we would not expect to find a language that makes no use of type $\langle e \rangle$. We would expect that all languages may refer to individuals

(type e) and attribute properties to them (<e,t>), that such properties are lexicalized etc. Type <d> is different (probably) from types e, t, s, i in that it is a constructed type: degrees can be seen as equivalence classes of individuals (all those that have the same height, for instance; see e.g. Klein (1991) for such a reconstruction). We can hypothesise that there is an inventory of types that is universally available - with the follow-up question what exactly that inventory is.

Von Stechow & Matthewson explore some further possibilities for universals concerning the systematic make-up of the content lexicon - for example: do all languages use the same basic building blocks to construct complex verb meanings (e.g. accomplishments): not all languages have accomplishments that entail reaching the result state. But do all languages employ a meaningful component DO (Dowty (1979))? - see their paper for details.

The DSP above is a point of systematic lexical **variation**. A well known candidate for a similar kind of parametric variation concerns NP semantics. Chierchia (1998) suggests the Nominal Mapping Parameter: Languages vary w.r.t. whether nouns like 'book', 'dog' denote properties <s,<e,t>> or kinds <s,e>. This systematic lexical variation shows up in the grammar of NP in terms of whether or not the language requires determiners, and whether or not it has plural marking and classifiers. See Chierchia (1998) for details as well as subsequent work including Chierchia (2010), Lima (2014) and Wilhelm (2008).

A different kind of systematic lexical variation which is not related to semantic type concerns the question of whether lexical predicates are all cumulative in the sense of Kratzer (2007) - that is, whether they are true of singular as well as plural eventualities. Beck (2012a) suggests that Konso verbs can be lexically either cumulative or not cumulative, and pluractional morphology can then pluralize or singularize them. The possibility of explicitly pluralizing as well as singularizing suggests a systematic lexical difference between Konso and English-like languages.

To sum up, there is reason to think that there is some systematic lexical variation. The instances in which this is plausible have repercussions for syntax and compositional semantics, and lead to typologically different languages for example in the areas of comparison constructions, NP grammar and pluractionality.

3.4. Case Study IV: Variables

3.4.1. Data: modal interpretation

The question pursued in this subsection is whether or not languages differ from each other w.r.t. the interpretive options they have for variables. The view of the interpretation component laid out in section 2 suggests that we ask this question in order to complete the overview of the components that contribute to composition. However, the case of variables is fairly difficult. Overt variables, mainly pronouns, immediately come with an intimate connection to questions of their syntax (e.g. Elbourne (2013)). Covert variables are widely assumed. But since they are invisible, they enjoy a large degree of freedom in the analysis and there does not seem to be a firm basis for generalizations.

Below, I take a stab at making a proposal. In the absence of (as far as I know) any concrete analyses that claim that there is crosslinguistic variation in the domain of variables, I do so for the sake of initiating the theoretical discussion. The phenomenon I choose to illustrate

my point is the interpretation of modals. I rely on the comparative work of Rullmann et al. (2008) (see also Chen et al. (to appear), Davis et al. (2009), Deal (2011), Matthewson (2013)). This section requires some familiarity with intensional semantics (see e.g. von Stechow & Heim (2010)).

Below are some standard examples of English modals and their analysis (Kratzer (1991) and elsewhere). The English modals *must* and *may* are analysed as universal and existential quantifiers over possible worlds, respectively, (49a,b). Both quantifiers are restricted, and the restriction is covert, context dependent. It is modeled with an accessibility relation R, which applied to the actual world yields the set of worlds quantified over in the modal statement - the modal base. This could be the epistemically accessible worlds, or the deontically accessible worlds, and so on ((50a,b)).

- (48) a. (In view of what we know/ what the rules say)
Polina must be at the meeting.
b. (In view of what we know/ what the rules say)
Polina may be at the meeting.

- (49) a. $\forall w'[R(w)(w') \rightarrow \text{Polina is at the meeting in } w']$
b. $\exists w'[R(w)(w') \ \& \ \text{Polina is at the meeting in } w']$

- (50) a. $R = \lambda w_1. \lambda w_2. \text{what we have evidence for in } w_1 \text{ is the case in } w_2$
b. $R = \lambda w_1. \lambda w_2. \text{what the rules provide in } w_1 \text{ is the case in } w_2$

This picture contrasts with the interpretive possibilities of modals in other languages. (51)-(54) from St'át'imcets (from Rullmann et al.) are chosen for illustration. The same modal can be understood as universal or existential. But on the other hand, the relevant accessibility relation is fixed. The modal *k'a* is always epistemic and the modal *ka* is (a.o.) deontic (see Rullmann et al. for a complete picture).

- (51) *Context: You have a headache that won't go away, so you go to the doctor. All the tests show negative. There is nothing wrong, so it must just be tension.*

nilh **k'a** lh(el)-(t)-en-s-wá(7)-(a) ptinus-em-sút
FOC **INFER** PREP-DET-1SG.POSS-NOM-IMPF-DET think-INTR-OC
'It **must** be from my worrying.'

- (52) *Context: There is some evidence that John has left, e.g. his bag has gone, but maybe he just took his bag to the bathroom.*

qwatsáts **k'a** tu7 k John, t'u7 wa7 k'a sxek
leave **INFER** then DET John but IMPF INFER maybe
k-wa-s cw7aoz t'u7 k-wa-sqwatsáts
DET-IMPF-3POSS NEG just DET-IMPF-3POSS leave
'John **may** have left, but maybe he hasn't left yet.'

- (53) *Context: I don't remember if we ate the rabbits or not.*

t'u7 wa7 **ka** n-scwákwekw-a ts'áqw-an'-em nilh
but IMPF **DEON** 1SG.POSS-heart-DET eat-DIR-1PL.ERG FOC

s-pápt-s-a wa7 tecwecw-wít lh-as kwís-alt I
 NOM-always- 3POSS-DET IMPF increase-3PL HYP-3CONJ fall-child
 sqweyits-a
 DET.PL rabbit-DET
 'But I think we **had to** eat them because they were always having babies.'

(54) *Context: You are going for a job interview and the receptionist outside the office tells you that you can leave your bag there, but you can also take it with you when you go in.*

lhwal-en-lhkácw **ka** lts7a tu wa7 s-zácen-su;
 leave-DIR-2SG.SUBJ **DEON** DEIC DET IMPF NOM-carry-2SG.POSS
 kwán-lhkacw lh-xát'-min'-acw
 take(DIR)-2SG.SUBJ HYP-want-RED-2SG.CONJ
 'You **can** leave your stuff here; take it if you want to.'

Thus St'át'imcets seems in a way the reverse of English in terms of what is lexically determined and what is flexible and subject to contextual interpretation.

3.4.2. Analysis

I provide a slightly simplified version of Rullmann et al.'s analysis of the modal *k'a* and St'át'imcets (52) in (55) (lexical entry) and (56) (LF and interpretation) below:

(55) Semantics of *k'a*:
 $[[k'a(f)(w)(\varphi)]]$ is only defined if f is a choice function of type $\langle st, st \rangle$. If defined,
 $[[k'a(f)(w)(\varphi)]] = 1$ iff for $\forall w' \in f(\lambda w)$. what we have evidence for in w
 is the case in w'): $[[\varphi(w')]] = 1$.

(56) $[[[[k'a f, w] [\lambda w' [John left w']]]]] = 1$ iff
 $\forall w' \in f(\lambda w)$. what we have evidence for in w is the case in w' : John left in w'
 "In all the worlds in which what we actually believe is the case selected by f ,
 John left."

Whether (56) amounts to an interpretation that is intuitively universal or one that is intuitively existential depends on the choice function. If f is the identity function, universal quantification over epistemically accessible worlds results. If f selects a subset of the epistemically accessible worlds, an existential statement results. See Rullmann et al. for more discussion. The choice function analysis models the apparently variable quantificational force. On the other hand, the epistemic modal base is hardwired into (55).

Compare this to the English LF (58) together with the standard lexical entry for the modal *must* (57) below:

(57) $[[must]] = \lambda p. \lambda q. \forall w' [p(w') \rightarrow q(w')]$

(58) $[[[[must R(w)] [\lambda w' [John left w']]]]] = 1$ iff
 $\forall w' \in R(w)$: John left in w'

(i.e., () becomes smarter)'

- (63) [[gakkoo ga yasumini-natta] yuki] [Matsumoto (1997)]
school Nom closed-became snow
'the snow (because of which) the school was closed'

(64) is a sketch of how a compositional analysis could be given for (63). It relies on a covert relational variable that makes the connection between the head and the modifier.

- (64) a. $[N' [[_{CP} \text{the school was closed}]_{\langle s,t \rangle} R_{\langle \langle s,t \rangle, \langle e,t \rangle \rangle}]_{\langle e,t \rangle} [N' \text{snow}]_{\langle e,t \rangle}]_{\langle e,t \rangle}$
b. $g(R) = [\lambda p. \lambda x. x \text{ cause } p]$
c. $\lambda x. \text{snow}(x) \ \& \ x \text{ cause } [\lambda w. \text{the school closed in } w]$

It seems that rather more pragmatic glue is available here than would be in English. So there might be some benefit in considering (60) in crosslinguistic semantic analysis. A further point of variation related to variables is suggested by Beck et al. (2009). The second of their three dependent parameters of variation in the domain of degree constructions (from Beck, Oda & Sugisaki (2004)) is given below:

- (65) Degree Abstraction Parameter (DAP):
A language {does/does not} have binding of degree variables in the syntax.

The negative setting of this parameter rules out structures like (66) below, which are involved in English *than*-clauses and degree quantification. Languages with the negative setting of the parameter would thus not make available parallel LF structures. I refer to Beck et al. (2009) and Hohaus, Tiemann & Beck (2014) for detailed discussion (see in particular Sudo (2015) for recent critical discussion of the original motivation for the DAP, Japanese comparatives).

- (66) a. $[1 [\text{John is } t_1 \text{ tall }]]$
b. $\lambda d. \text{Height}(\text{John}) \geq d$

What about possible **universals** in the area of variables? It is built into the theory sketched in section 2 that there are natural language variables. Are there variables that we'd want to say all languages have? The simple types *e*, *i*, *s* and *v* would be good candidates. Note also that if there were no variables, nothing would feed PA and the candidate universal from sections 3.1 and 3.2. would run empty. But anything more interesting we could propose (e.g. "all natural language quantification is contextually restricted") immediately becomes controversial at least in terms of specific implementation (see e.g. the papers in Matthewson (2008b)). I must leave this whole area for future research.

3.5. Case Study V: The pragmatic step

3.5.1. Data: Presupposition in St'át'imcets vs. English

This final subsection asks if we find crosslinguistic variation in the pragmatic step. Do languages vary in terms of the speech act that yields the pragmatic meaning of an

utterance? Matthewson's (2006a) analysis of presupposition claims that such variation exists (also Matthewson (2008a)). She observes St'át'imcets presuppositional sentences do not show the same pragmatic behaviour as English presuppositional sentences.

One empirical motivation for the notion of presupposition is the fact that utterances whose presuppositions are not established as true can be rejected for that reason. Von Stechow (2004) proposes the 'Hey, wait a minute' test as a diagnostic for English presuppositions (see Tonhauser et al. (2013) for a recent discussion of how to diagnose presupposition and projective meaning components in general). (67) is an example. A presupposition whose content is not established in the conversation can be challenged with 'Hey, wait a minute', but an assertion cannot.

- (67) context: no prior discussion of anyone going to Paris.
 A: Henry is also going to Paris.
 B: Hey, wait a minute! Who else is going to Paris?
 B': # Hey, wait a minute! I didn't know he was going to Paris.

Matthewson observes that the same doesn't hold in St'át'imcets:

- (68) *Context: Addressee has no knowledge of anyone planning a trip to Paris.*
 A: nas t'it áku7 Paris-a kw s-Haleni lh-klísmes-as
 go also DEIC Paris-DET DET NOM-Henry HYP-Christmas-3CONJ
 'Henry is also going to Paris at Christmas.'
 B: o áma
 oh good

In (68), B does not challenge the presuppositional sentence although the presupposition is not established in the context. This is the typical kind of response, for all items that are plausibly presupposition triggers in the language (including counterparts of *also*, *again*, *stop*). Matthewson argues that the lack of the 'Hey, wait a minute' response is systematic, and it is not because the items are not presuppositional. Her analysis is that they have the same presuppositional semantics as the corresponding English items (as evidenced by the fact that the presuppositions project). What differs is the pragmatics of the utterances containing them. See also Tonhauser et al (2013) for an investigation of presupposition crosslinguistically and comments on Matthewson (2006a).

3.5.2. Analysis

What I present below is my implementation of Matthewson's (2006a) analysis. It is formally more explicit but intended to follow her proposal. Let's first spell out the analysis of English. For our purposes, the semantics of (67a) can be rendered as in (69):

- (69) $\lambda w:\exists x[x \neq \text{Henry} \ \& \ x \text{ go to Paris in } w].\text{Henry go to Paris in } w$

We follow Heim & Kratzer (1998) in modelling presupposition as partiality. (69) is undefined in worlds in which there isn't someone other than Henry who is going to Paris. What happens when such a partial proposition is uttered?

The standard analysis (Stalnaker (1973)) assumes that the participants in a conversation share a set of assumptions. The common ground c is the set of worlds in which all those assumptions are true.

(70) $c = \cap p$: speaker S and hearer H assume p for the purposes of the conversation

(and both H and S assume that the other does so etc. - I simplify here.)

When a proposition is uttered in the context of a conversation, the common ground is updated with the proposition, $c \cap p$. When p is a partial proposition, this is only successful if the presuppositions of p are true in the worlds in c (von Stechow (2003) calls this 'Stalnaker's Bridge'). I model the update for present purposes with an Assert operator in the style of Krifka (1995):

(71) $\text{Assert}_{\text{Engl}}(p)(c)$ is only defined if for all worlds w such that $w \in c$: $p(w)$ is defined.
If defined, $\text{Assert}_{\text{Engl}}(p)(c) = c \cap p$

This means that English (67a), expressing the proposition (69), can only be successfully asserted in a context c if for all worlds w in c : $\exists x[x \neq \text{Henry} \ \& \ x \text{ go to Paris in } w]$. In other words, if the context (the shared assumptions of S and H) entails that someone other than Henry is going to Paris. If this is not the case, the hearer H can challenge the speaker S 's utterance of (67a) ('Hey, wait a minute!'). This means H refuses to accept the update. (The hearer does not have to challenge the speaker's utterance when it contains an unestablished presupposition. Sometimes, an alternative possibility is for the hearer to accommodate the presupposition, that is, to assume that the presupposition is in fact true. In the case of *too/also*, accommodation is generally not possible (e.g. Heim (1990))).

Let's now turn to St'át'imcets. Matthewson (2006a) argues that the behaviour of presuppositional sentences in St'át'imcets indicates that the presuppositions are not evaluated against the common ground. Instead, she uses Gauker's (1998) notion of 'objective propositional context': facts that are relevant for the purposes of the conversation, which speaker and hearer do not necessarily (both) have to assume. Moreover, the analysis relies on the idea that the **speaker** assumes certain such facts or takes them for granted (rather than speaker and hearer both). I render this as follows:

(72) Let C be Gauker's objective propositional context (the intersection of the set of facts relevant for the purposes of the conversation).

$c_S = \{w: w \in C \ \& \ w \in \cap p: \text{ speaker } S \text{ assumes } p \text{ for the purposes of the conversation}\}$

$c_H = \{w: w \in C \ \& \ w \in \cap p: \text{ hearer } H \text{ assumes } p \text{ for the purposes of the conversation}\}$

$c_S \cap c_H = C$ (simplifying again as before.)

Given this, we can define a slightly different Assert operator for St'át'imcets:

(73) $\text{Assert}_{\text{St}}(p)(C)$ is only defined if for all worlds w such that $w \in c_S$: $p(w)$ is defined.
If defined, $\text{Assert}_{\text{St}}(p)(C) = C \cap \{w: p \text{ is defined in } w\} \cap p$

The utterance of example (68) has the same semantics (69), but uses the operator in (73). It is thus only appropriate if the speaker assumes that the presuppositions of the sentence are true (i.e. that someone other than Henry is going to Paris). The hearer, however, needs to have made no such assumption. When s/he accepts the utterance, the presupposition is added to her/his assumptions along with the assertion (similar in effect to accommodation in English, but coming from a different source).

3.5.3. Summary and Outlook

Matthewson's (2006a) analysis proposes that there is significant parametric variation between languages concerning the pragmatic step. The way I have modeled this above makes this variation in the set of speech act operators like Assert that languages use.

This variation is rather surprising. One might have expected assertion to be the same across languages. We immediately wonder what other options languages might come up with, and what variation there might be with other such operators. Krifka (1995) proposes the operators ScalarAssert and EmphaticAssert in addition to simple assertion. In more recent work, Krifka (2014) develops a systematic theory of speech acts in which speech act operators are part of the composition. We can combine such a theory with an analysis of evidentials according to which the evidential acts at the speech act level: "the speaker has ... evidence for asserting/presenting p" (Faller (2002), Matthewson (2010) a.m.o.; see e.g. Korotkova (2016) for recent discussion). Accordingly, some languages would have speech act operators like the ones in (74).

- (74) a. $EVI_{\text{visual-evidence}}$:
 $\lambda p: c_{sp}$ has visual evidence for p. Assert(p)(c)
b. $EVI_{\text{inferential}}$:
 $\lambda p.c_{sp}$ infers p from the available evidence. Assert/Present(p)(c)

These are speech act operators that languages like English do not necessarily have, and hence another candidate for language variation w.r.t. the pragmatic step. I summarize the observations in this section in terms of the question in (75).

- (75) (How) do languages vary w.r.t. which speech act operators they use?

The question of variation in this area is especially pressing for the semanticist given the recent debate about the semantics/pragmatics interface and whether such operators can be structurally represented, embedded etc. (e.g. Chierchia, Fox & Spector (2011) who develop a syntactic analysis of Krifka's (1995) ScalarAssert a.k.a. EXH). Hopefully the operators available would have something in common - for instance, one would suppose that languages need an operator Assert whose meaning includes updating a context with a proposition. I am not aware of further work on the subject and have nothing more to add at this point.

4. Conclusions

4.1. Summary

The list in (76) summarises the parameters presented in section 3. In (77) I list further possible points of parametric variation mentioned, but not discussed explicitly in this paper. (78) lists some of the questions raised about possible points of semantic variation.

(76) parameters proposed:

- a. **(R) parameter:**
A language {does/does not} have Principle (R).
- b. **Sequence of Tense parameter:**
A past tense verb form {is/is not} licensed by a superordinate PAST operator.
- c. **Degree Semantics Parameter DSP:**
A language {does/does not} have gradable predicates (type <d,<e,t>> and related).

(77) further candidates for semantic variation:

Noun incorporation, properties of LF movement, Nominal Mapping Parameter, Degree Abstraction Parameter DAP.

(78) questions raised about parametric variation:

- a. **Composition:**
To what extent are the constructions that use an alternative semantics crosslinguistically variable?
- b. **LF syntax:**
Do all languages generate parasitic movement LFs?
[2[1[... x1 ... x2 ...]]
- c. **Lexicon:**
Is a (universal?) inventory of possible function morpheme meanings distributed differently across languages?
- d. **Variables:**
(How) do languages differ in terms of what variables they make use of?
Do some languages lack accessibility relations?
- e. **The pragmatic step:**
(How) do languages vary w.r.t. which speech act operators they use?

Let me also give an overview of the possible universals that have come up. As some reviewers have pointed out to me, the composition principles of FA and PA are almost a built-in feature of the theory of compositional interpretation sketched in section 2. Semantic theory views the combination of saturated and unsaturated meanings as the basic combinatory principle (see e.g. the discussion in Chung & Ladusaw (2004)). This leads us to expect that FA is universally available. Similarly, in frameworks with variables (see e.g. Jacobson (1999) for a variable free semantics), the existence of variables is built in and their binding is practically taken for granted. The resulting picture is one in which natural language has expressions that are variables, LFs in which they are bound, and a principle of composition which interprets these structures. That is, there is an expectation that PA should be universally available.

But note that this does not make the composition principles FA and PA any less universal. It means they are universals accounted for by semantic theory. It's a good thing that certain universal properties of human languages are built into the semantic theory.

In addition to these design feature universals, we have come across the following further candidates for semantic universals:

(79) candidates for universals:

- a. All languages make use of a tier of alternative semantic values.
- b. There is a universal inventory of types used by expressions in human languages which probably includes the basic types e,t,s,i and v and (some) complex types built from them.
- c. Functional elements (like aspect and modal operators) are made up of the same basic building blocks crosslinguistically.

While this specific collection of parameters, universals and questions in (76)-(79) is a little accidental (reflecting those areas of compositional semantics that I am most familiar with), it should still be representative of the state of our knowledge in general terms.

Examining the four lists, we are led to the following conclusion: The wealth of observations that are coming in about specific languages have not yet led to a theory of semantic variation. We need a detailed and comprehensive compositional analysis of a relevant fragment of a language in order to talk about its grammar and points of variation in the grammar, and this is not easily available.

Even so, there are a few attempts at principled explanations for medium-scale (e.g. resultatives, degree constructions, sequence of tense) or large scale language variation (e.g. nominal mapping, incorporation). And there are a few intriguing observations about language variation that is not really anticipated in the theory we have built so far (e.g. variables, presuppositions).

4.2. Outlook

The work reported above motivates the hypothesis **(H)** and consequently the research question **Q2** I propose to guide us in our crosslinguistic semantic research.

(H) Variation per component hypothesis:

Each component of the grammar that contributes to compositional interpretation has a stable core and a variable part.

Q2: Which part of each grammatical component is universal and which part is crosslinguistically variable?

For some components, the crosslinguistic semantic analyses that are coming in provide a basis for first motivated hypotheses about parameters and universals. This concerns mostly the syntax/semantics interface. We are beginning to understand better the options for the interplay between syntactic structure, lexicon and composition principles. As for the semantics/pragmatics interface, things seem to be much more up in the air. In order to

make progress, we need many further detailed semantic analyses of interpretive phenomena in languages other than English.

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