Revised March 2022

Formal semantics and historical linguistics

Regine Eckardt
Konstanz

Introduction

In spite of the long tradition of research on meaning change, investigations of meaning change in terms of truth conditional semantics (TCS) have only recently gained momentum. TCS can offer detailed analyses of the compositional structure of phrases and clauses in terms of truth conditions, presupposition theory, the expressive dimension, indexicality and discourse analysis. This is advantageous when we want to

- describe the sentence content in terms of semantic buidling blocks,
- describe the semantic composition of phrases and sentences,
- describe how words and their meanings compete in paradigms, e.g. by forming horn scales,
- propose and test semantic universals, and explain directions of change.

While traditional grammar is good at detecting meaning change at the level of content words (e.g., narrowing: *mete > meat*, metonymy: *school* (institution) > *school* (building)), the intuitive description of meaning reaches its limits when we look at the semantic changes of functional words. Such changes are therefore in danger of being misconceived, up to a point-blank denial of meaning change as voiced by Haspelmath:

> […] I am not sure that [semantic grammaticalization] is as central to the process as has generally been assumed, … For instance, the emphatic negation marker *pas* in older French has lost its pragmatic markedness and has become the mormal negation marker, without any semantic changes in the narrow sense having taken place."
> (Haspelmath 1999: 1062)

Similarly, Eberhardt notes in her discussion of the change of German *zumal* from focus marker to subordinating conjunction: "I do not consider the development of *zumal* to be a grammaticalization process, since it is a product of structural reanalysis at the syntactic level *without a shift from the old to the new meaning.*" (Eberhardt 2017, section 5, emphasis mine). As focus markers and subordinators play very different compositional roles, this diagonsis is bound to be wrong on compositional grounds. Similarly, Haspelmath's bold diagnosis of matters in the Jespersen Cycle will be criticised in section 4.

      The article is structured as follows. Section 1 shows first analyses of meaning change in truth conditional semantics and uses examples to introduce basic assumptions and notation. Section 2 reviews two studies that use TCS in order to reveal competition in grammatical paradigms as driving force in semantic change. Section 3 demonstrates how seemingly vast semantic leaps between stages can be accounted for by reanalysis in TCS, drawing on recent research on Old English modals and German focus particles. Section 4 takes a closer look at small changes when clauses are re-build in morphosyntax and meaning in parallel. Specifically, we discuss the Jespersen Cycle and the subtle

semantic changes of *again* in the history of English. Finally, synchronic research in formal semantics has unveiled important semantic universals, and section 5 discusses how these universals delimit the range of possible meaning change. Section 6 concludes.

1. Framework, basic assumptions and first examples

Longobardi (2001) analyses the emergence of the French local preposition *chez* ('at') from the common noun *casa* ('house') in Latin. He argues that *casa* was used in determinerless possessive constructions such as *casa mia* ('my house') or *casa di Giovanni* ('John's house'). He proposes that in a series of syntactic reanalyses, the noun *casa* was reanalysed to occupy first a D^0 position and finally the P^0-position for prepositions, leading to the modern French *chez*. This change in syntax is mirrored in semantics: The noun *casa* denotes the property 'house'. The preposition *chez* takes a place x as its argument and returns a local modifier "be or happen at x". In semantic notation, the meanings are rendered as follows.

$$[[\textit{casa}]] = \lambda x[\text{HOUSE}(x)]$$
$$[[\textit{chez}]] = \lambda x \lambda y[\text{BE-AT}(y,x)]$$

Brackets [[.]] indicate that we refer to the meaning of words. The notation reflects that the newer *chez* relates two objects (place and locatum) while the older *casa* denotes the property 'being a house'.

Traugott (2008) discusses the development of the determiner *a lot of*. The older syntactic structure of the phrase *a lot of wood* combines the measure phrase *lot* with its complement PP *of wood,* and finally with the determiner *a*.[1]

(1)   [DP a_det [NP lot [PP of wood]]]

This structure is justified by the fact that *lot* could also be combined with other determiners, such as *two*, *three* or *several*. After syntactic reanalysis, the fixed phrase *a lot of* takes the determiner position in a simpler DP.

(2)   [DP *a-lot-of* [NP wood]]

Being no longer composed of meaningful parts, the phrase *a lot of* can undergo phonological reduction "*a lotta wood*" (Hopper and Traugott 1993). On the semantic side, the phrase (1) combines the measure unit *lot* with an argument *wood* and finally the existential determiner. In (2), the string *a-lot-of* denotes an existential quantifier that states 'there is a considerable quantity', while the noun contributes the kind of object in existence. TCS captures determiners as relations between two properties. The following terms show the meaning of *lot* before and *a lot of* after the change.[2]

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[1] A *lot* is the unit of goods sold for biddings in an auction.
[2] Determiner denotations in this section can be spelled out in various ways that are logically equivalent. For a detailed treatment of quantifiers see (Portner 2005, Heim and Kratzer 1998, von Fintel and Heim 2007, Partee 1989).

(3)   a.   [[*lot*]] = λPλx[SIZE(x) = LOT & P(x)]
            'given P, applies to pluralities x of kind P that count as one lot in a
            contextually given auction'
       b.   [[a lot of]] = λP λQ (SIZE_OF(P(x) ∩ Q(x)) ≥ *d*)
            'given properties P, Q, the size of the intersection P ∩ Q is above
            threshold *d* that counts as *many*'

P and Q in (3b) are contributed by the nominal argument and a projection of
the verb in the clause.
       TCS aims to capture the logical contribution of content words but also
the compositional structure of phrases and sentences. In its currently most
widespread format, denotations of words and phrases are given in terms of type
logic that reveals not only the logical nature of words (refering to entities, to
properties, relations between two relata, relations between three relata etc.) but
also how words can bring together other words in the course of semantic
composition. Determiners like *every, many, a lot of* will serve to illustrate the
idea. In the simplest case, determiners combine with a sister noun and a verb
to yield a sentence, like in (4).

(4)   [CP [DP *Many*Det [NP *dogs*]] [VP *barked*]]

Nouns contribute properties of entities. Using the bracket notation again, the
meaning of the noun *dog* is given as in (5).

(5)   [[*dog*]] = λx.DOG(x)

Intransitive verbs likewise refer to properties of entities, even though these are
more temporally limited properties. Hence *bark* refers to λx.BARK(x). The
determiner *many* says something about how two such properties relate to each
other in the world: The intersection of the two properties contains a large
number of entitites; roughly 'more than one would expect' (Partee 1989). This
is captured by the following term.

(6)   [[*many*]] = λPλQ. MANY x(P(x) ∩ Q(x))

The prefix λP indicates that a propery P is needed as a first logical argument of
the quantifier. The prefix λQ stands for a second property. The remaining term
codes how these are to be combined: P and Q intersect and the size of the
intersection counts as large. The meaning of sentence (4) is computed as
follows.

(7)   a.   [[*barked*]] = λx.BARK(x)
       b.   [[*dogs*]] = λx.DOG(x)
       c.   [[*many dogs*]] = λQ. MANY x(DOG(x) ∩ Q(x))
       d.   [[*many dogs bark*]]
            = MANY x(DOG(x) ∩ BARK(x))

In (7c) the nominal predicate instantiates P, and in (7d) the verbal predicate
instantiates Q. The analysis predicts the sentence to be true in every situation

where the set of dogs that bark is large. *Many* shares the logical structure of determiner meanings that all serve to relate two sets to each other. In notation, they all share the prefix λPλQ(…P…Q…) and an instruction how P and Q are related. The guiding hypothesis in TCS assumes that all items of the same syntactic category share the same logical type (Montague 1970). This restricts the range of possible denotations of words considerably, a fact to which we return in section 5.

Regarding to our initial example *a lot of*, we can now state in more detail what happens in semantic reanalysis. At the phase of change, hearers encountered uses of *a lot of N* that invited a newer, leaner analysis. Hearers understood that the existence of "a large quantity of N" was asserted. But what seems to have gotten lost was the conceptual connection to an auction and buying by betting.[3] Thus, hearers construed *a lot of* as a determiner—that is, a logical operator that brings together two properties. The contributed content, intuitively, was that the intersection P ∩ Q was large. Hearers had to solve the semantic equation in (8).

(8)   Find some operator **D** such that **D**(NOUN(x) ; VERB(x)) is true iff the set NOUN(x) ∩ VERB(x) contains a larger number of things than expected. Limitation: **D** must share the logical type of determiners $<<e,t>,<<e,t>,t>>$.[4]

It is obviously part of our linguistic competence to do such equation solving in suitable contexts. Contexts of reanalysis have been called *bridging contexts* in earlier literature on grammaticalization (Diewald 2002, Heine 2002, Lucas and Willis 2012) and will be inspected more closely in section 5. Truth conditional semantics can explicate the change in bridging contexts.

2. Paradigms and competition

Formal diachronic analyses can help to uncover pragmatic competition and explain the dynamics of grammatical paradigms. This is illustrated by Ashwini Deo's work on the progressive-imperfective cycle and by a study of Gerhard Schaden on the development of indefinite determiners.

Deo (2015) investigates the meaning shift from *progressive* to *imperfective* marker, attested in many languages. Progressive markers are typically used to present events as taking place during and beyond reference time *i*, whereas imperfective markers convey habitual and generic statements. This shift is unidirectional, a finding evidenced by the historical records of many languages and established in earlier studies. Moreover, languages with distinct progressive and imperfective markers show them in complementary distribution. However, languages with an extended written record have earlier stages where a form that was to be an imperfective form at later stages could still be used in both senses. This raises the question whether the two meanings

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[3] Traugott offers no historical data as to what everyday situations would downtone the presupposed context of auctions and bidding. See Eckardt (2009) for the avoid-pragmatic-overload principle.

[4]) The type states that **D** relates two properties (see Heim and Kratzer (1998) for the notion of logical type).

are semantically distinct, or whether we see vague meanings and conventionalized patterns of use.

Deo solves this puzzle with an overarching framework for progressives and imperfectives. She suggests that aspectual forms refer to time intervals *i* by way of regular partitions: sets of subintervals {*j, k … n*} that divide *i* into non-overlapping parts which together cover *i.* Imperfectives and progressives, combined with a verbal predicate *P,* express that there is an ongoing time interval *i* such that *P*-events happen in all subintervals {*j, k … n*} of the respective partition. If *i* is a short time interval, the envisaged partition must be fine-grained. This leads to the progressive reading, with the same *P*-event continuing over the interval *i.* This reading is triggered in particular if *i* is the (short) reference time. If the time interval in question *i* is larger and the partition coarse-grained, the resulting statement conveys that *P*-events happen regularly, which accounts for habitual or generic readings. The distinction between progressive and habitual, Deo suggests, is basically one of short vs. long time frames. Her basic idea is integrated with a modal dimension so as to cover progressive readings for interrupted events, as well as habitual/generic readings that are interrupted in the real world due to unforseen circumstances (Dowty 1977).

Deo proposes that the granularity of partitions is conventionalized for different forms. Where two forms PROG and IMPF compete, the fine-grained PROG reading asymmetrically entails the broader IMPF reading, thus building a Horn scale <PROG, IMPF>. The account predicts that sentences about events-in-progress will use the more informative PROG form, with IMPF by privative opposition being confined to reports about extended time frames *i,* and thus reserved for habitual or generic statements. As Deo's specific phrasing of PROG leads to the implicature that the events in question will *end* at some point, stative predicates are excluded from PROG forms, as for instance in English **Pete is knowing the answer.*[5]

Deo argues that an overarching analysis of PROG and IMPF can also cover the development of progressive-imperfective systems over time. Aspect-neutral languages have one form for all aspects, with interval size and partition adjusted *ad hoc* to each utterance. Languages typically innovate forms for the *progressive*, including the semantic instruction to apply only to reference time *i.* New PROG forms being morphologically more complex, these novel forms are reliably restricted to the progressive reading. As they are getting more common and over-use can occur, languages will enter a second phase where newer PROG forms expand into the semantic realm of former IMPF. Finally, the former PROG form can turn into a aspect-neutral marker, replacing the former IMPF forms. The resulting system is in the initial phase and the cycle can start anew. In a related strand of research, Condoravdi & Deo (2015) investigate the changes in the tense-aspect system of Indo-Aryan, specifically the expansion of the aspect marker *-ta* from resultative to perfective to past tense.

The dynamics of privative oppositions is also at the core of Schaden (2020). Schaden investigates the development of determiner paradigms, specifically the rise of indefinite determiners that branch out of number terms for 'one' (Heine & Kuteva 2002). Schaden's case of study is Latin *unus* and its opposition

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[5] The reader is referred to the original paper for the details of the competition.

to bare nouns, as they are used in the *Vulgate*. He argues that the meaning and pragmatic behaviour of *unus* determines its range of uses: Unlike definite DPs, *unus* doesn't carry a uniqueness presupposition. This renders *unus* compatible for *one – another* contexts as well as for partitive readings *one of the … .* As a number term, it can moreover be used to contrast with *many (pluribus)*. Referring to evidence in many modern languages, Schaden argues that the number word *unus* literally means "one, not more" and thus differs from indefinite determiners which do not logically entail "… and not more".

As *unus* is morphologically more complex as well as semantically more specific than bare nominals, Schaden predicts that *unus* is used in order to signal marked content (in terms of Levinson 2000). The *Vulgate* includes ample illustration for this prediction, for instance when *unus* is regularly used to convey wide scope readings, or reference to specific objects. Other marked contents include the writers' use of *unus* to convey contrast to *many (pluribus)*, for instance when stressing the fact that Christian belief knows only *one God*.

Unlike an analysis in terms of fixed use conditions, Schaden's pragmatic account can also accommodate rare uses of *unus* of unclear pragmatic "benefit". Most challenging are minimal pairs such as the following two passages.

(9)   *latitudo   [habebat]   cubitum   et   dimidium*
        width.nom   had   cubit.acc   and   half.acc
        'It [the arc of the covenant] has a width of a cubit and a half
        Exodus 25:10

(10)   *pariter=que   habebat   unum   cubitum   et   dimidium*
          similarly = and   had   UNUS.acc   cubit.acc   and   half.acc
        'And similarly it measured one cubot and a half.'
        1 Kings 7:31

As Schaden observes, the two sentences are truth conditionally equivalent and *unus* doesn't show scope or specificity effects. He proposes that the choice of the more complex form 'unum cubitum' might serve to implicate greater precision or the speaker's reliabile knowledge of facts. It is unclear whether hearers at the time would understand the intended implicature or not. Hearers who wanted to avoid pragmatic overload could instead sense an over-use of *unus* and infer a weaker meaning (Eckardt 2009). Schaden demonstrates how *unus* changed into indefinite *un*(*e*) in French by loss of the numerical upper bound "not more than one", followed by the loss of potential contrast to other numerals. Extended use led to phonological weakening and, finally, the anti-presupposition of introducing a *novel* referent to the discourse, as opposed to definite noun constructions that presuppose the existence of a unique referent.

Schaden's semantic entries for *unus*, their Modern French indefinite descendant *un* and the competing definite *le/la* make a clear case against a traditional view voiced in Pozas Loyo (2010), who suggests that the development from unity cardinal to indefinite determiner does not involve any meaning change but boils down to a simple increase in frequency of use. Yet, the cline from number word to indefinite article undeniably has the flavour of a gradual shift: Schaden's data demonstrate that descriptive stages of indefinites cannot plausibly be captured by different lexical entries. Taking Heine's (1997)

stages (1) *numeral,* (2) *presentative*, (3) *specific,* (4) *nonspecific* and (5) *generalized* as an example, Schaden finds examples for all "readings" except (5) in the *Vulgate*, which seems to contradict the traditional view that *unus* was a numeral at that time. Likewise, stages do not cleanly align with fixed constructions (e.g., Heine (1997) proposes *once upon a time, there was a king…* for (2)). Traditional accounts, therefore, leave it unclear how speakers would keep track of novel contexts in order to code new lexical entries. According to Schaden's analysis, these readings arise spontaneously in context, based on pragmatic competition between *unus+N*, bare nouns and deictic constructions (*ille,* possessives etc). He thus covers the data on basis of one lexical entry *unus,* interacting with pragmatic enrichment but in clear semantic opposition to the eventual indefinite *un(e)*.

The lesson taught by these studies could be summarized as follows: We need to know the specific semantic and pragmatic properties of a given construction in order to understand how it competes with other items. Competition allows us to explain the directions of change and to pinpoint the shift from one stage to another, as opposed to shades of meanings by pragmatic enrichment.

3. The basis of leaps in meaning change

While the last section looked into formal models of gradual semantic change, the present section focusses on changes that appear to involve large leaps between semantically different word uses. Such large-scale change has sometimes been misinterpreted as evidence that speakers (of certain languages at certain times) did not really understand the meanings of words, and invite the false belief that meaning is an ill-defined part of language. The case studies in this section argue that some changes can look drastic and still rest on precise semantic steps and stages.

Modern modals like *must, can, may, shall* are assumed to express quantification over possible worlds, with necessity modals expressing universal quanfication while possibility modals are existential (Kratzer 2012). This view is challenged by the finding that OE *motan* was used sometimes in a possiblity sense and sometimes in a necessity sense, as illustrated in (11) and (12).

(11) *Gif he us geunnan wile, þæt   we hine swa godne gretan*
      if   he us grant   will   that   we him   so   good greet
      moton
      mot.PRS.PL
      'If he will grant us that we *moton* greet him, the good one.' (Beo:347)

(12) *londrihtes   mot   þære   mægburge monna æghhwylc*
      of.landright mot.prs.ind.3sg of-that kin   of.man each
      idel   hweorfan.
      idle   wander
      'Every man of that kin *mot* wander without the rights of the rightful
      residents' (Beo:2886)

Philologists argue convincingly that (11) is meant to say 'we can/may greet him' while (12) states that men 'must' wander without rights. Given that universal and existential quantification are logically distinct operations, such data are suited to cast doubt on speakers' ability to master the most basic logical distinctions.[6]

Yanovich (2016) proposes that the seemingly opposing readings result from one common semantic entry for *motan*. According to his Variable Force hypothesis, "motan(p) asserts that p is an open possibility and presupposes that if p is given a chance to actualize, it will" (Yanovich 2016: (14)). In order to elaborate this hypothesis, Yanovich examines all 71 uses of *motan* in Ælfred's translations of Gregory's Cura Pastoralis (CP), Boethius's Consolatio Philosophiæ (Bo), and Augustine's Soliloquies (Sol). Investigating the "existential" uses in particular, he observes that all refer to circumstances where "if *p* is possible, then *p* will inevitably happen". For instance, we find in Bo the passage *and make me worthy of it that I* **mote** *see you.* Although the paraphrase 'that I **can** see you' is suited to render the sentence in ModE, anyone who has the possibility to see God will strive to take this possibility, and thus will see God by necessity. This particular nuance, common to all existential uses of *motan* in OE, was described informally in traditional philology.

Yanovich can cash out this observation, building on extensive literature on modal variability in present-day Salish languages (Rullmann et al. 2008, Peterson 2010, Matthewson 2013). Following this work, his formal account for OE combines different modal flavours (metaphysic, circumstantial, deontic) in semantic composition to predict the logical collapse of universal and existential reading in the critical examples. The analysis entails that there was one unambiguous *motan* in OE, equally well in line with the logic of quantification as are the variable force modals in Salish languages. He argues that the situation changed in ME when the older word branched out into two homonyms *motan*, one existential (lost over time), and a universal that remains until today. Yanovich's work makes a convincing case that speakers knew their quantifiers at all times, even if their language use might suggest otherwise at first sight.

The emergence of particles offers another domain where older and newer meanings can be almost paradoxically opposed. German *selbst* 'even' developed from intensifier *selbst* close to Englis 'self'. English *even* 'smooth, flat' developed into *even* 'just then, just so' and finally into the scalar particle *even* that means anything but 'flat' (Traugott 2006). Similarly, OE *fast* was an adjective/adverb meaning '(fix) immovably' and also '(hold) tightly' but today is used mostly in the sense 'with high speed'.[7] The modern word *again* goes back to OE *angegin*, cognate to ModHG *entgegen* 'in the opposite direction' which seems counter to the idea that something happens for a second time (Beck & Gergel, 2015). Formal diachronic semantics helps to better understand how these leaps in meaning come about.

Eckardt (2006) investigates the change of German *selbst* from intensifier to focus particle. Intensifying *selbst* is attested in Old and Middle High German, and still exists in English and German.

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[6] See Yanovich (2016) for references.
[7] See Eckardt (2010) for the reanalysis of *fast* to mean ,almost' in German.

(13)   *The king himself opened the door.*
(14)   *Der König selbst machte die Tür auf.*

The intensifier associates with a referential DP and has the semantic effect of presenting the referent as central in an entourage of alternatives (Edmondson and Plank 1978, König and Siemund 1996, Eckardt 2001). The use of *selbst* in the sense 'even' arose between 1600 and 1700. In the turning period, we find bridging examples like (15) (simplified, see Eckardt 2006: 179).

(15)   *'The roads are deserted, the father flees the son, …*
        die Vögel selber fliehen in die Wüsten
        the birds selber flee into the deserts
        (Opitz, 1624)

In its older sense, *selber* presents *die Vögel* ('the birds') as central in some entourage. Eckardt (2006) argues that the center-entourage effect comes about by obligatory focus on *selber* (called "stressed selbst" in previous literature). The modern construal of (15) states that birds are the least likely animals to leave. By relocating the place of focus (from *selber* to *Vögel*) and solving the semantic equation for the word *selber_{new}*, hearers would form a hypothesis about the new sense of *selbst*. Notably, focus was one of the semantic elements of the sentence remaining in play, although in a different position.

The sentence denotations under the older and newer analysis are similar in truth conditions. The older (intensifier) reading, however, requires the reader to accommodate a model of the animal kingdom in which the birds are central while humans and other animals are peripheral. This was an uncommon way to structure the world then, as it would be today. The newer reading allows for sentence-wide focus and can be paraphrased as follows.

(16)   Among the the propositions *'the roads are deserted', 'the fathers desert their sons', 'the birds flee into the deserts'*, the last on is the least likely to be true.

The new meaning requires less "surprising" accommodations, thus avoiding pragmatic overload. This made the newer construal pragmatically simpler, favouring the new sense [[*selber_{new}*]] = [[*even*]] (Eckardt 2006, 2009).

The two reported studies illustrate that seemingly large semantic change can be effected by reanalysis. In suitable contexts, the same sentence meaning can come about by different builts of the clause, using words/constructions in older and newer senses. This may sound like a banal truism at the level of content words[8], but formal diachronic semantics verifies the same principle at the level of functional words.

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[8] Take for example the English noun *beads* with older sense ‚prayer' and newer senses ‚a small perforated ball or body' (as in ‚string of beads' for necklace). While these concepts are wide apart, the sentence „He is counting his beads" had nearly the same truth conditions in contexts where believers pray with rosaries (see OED, entry *bead*).

4. Subtle change at the subsentential level

The previous section argued that formal diachronic semantics helps to explain instances of dramatic meaning change, but more challenging are diachronic develoments with smaller changes at the subsentential level. Formal semantic analyses can bring to light such subsentential changes, as the present section will illustrate by Beck & Gergel's (2015) work on *again* and a discussion of the Jespersen Cycle, alluded to in Haspelmath's quote.

The adverb *again* and its synonyms in other languages have been at the focus of semantic debate for decades. Two uses were identified, the restitutive reading ("*the window opened, and Peter closed it again*") and the repetitive reading ("*Peter ringed the bell again*"). Beck and Gergel focus on a third, counterdirectional reading, attested in OE but losing ground around EarlyModE.

(17)   *'Tis like people that talk in their sleep,*
         nothing interupts them but talking to them again […]
         (Dorothy Osborne, 17th c., quoted after Beck & Gergel)

ModE would render the last sentence as 'but talking back to them'. Based on a comprehensive survey of the attested readings of *again*, the authors conclude that the repetitive/restitutive reading developed from the counterdirectional reading in (17). They propose a development along the following stages: The oldest use, prepositional *again* as with the ModE cognate "Peter swam against the current", rests on the notion that events can have a path argument along which the activity develops, with the start coinciding with the beginning of the event and the end marked by the event's end. Beck and Gergel paraphrase their formal analysis as follows.

(18)   *x* is involved in an event *e* with a path, and follows the reverse path in another (understood) event *e'*.

The counterdirectional use of adverbial *again* derives directly from the preposition. Beck and Gergel propose the following analysis: Assume that the bare sentence S conveys that a P-event took place.

(19)   In this case, the sentence *again S*
         • asserts that an event e of type P with a path argument took place.
         • presupposes an earlier event e' along the reverse path.

At the next stept, counterdirectionality was conceived of in a wider sense in examples similar in structure to the following (Beck&Gergel 2015: (86)).

(20)   *Galahad hit Lancelot. Lancelot hit Galahad again.*

To account for these, they propose that the presuppositions in (19) were weakened to "the relevant earlier event *e'* was of the opposite nature". Such examples offered an entry point for uses for the repetitive reading.

This may sound surprising, as the presuppositions of counterdirectional and repetitive readings seem almost mutually exclusive: "the *opposite* has happened before" changes into "the *same* has happened before". Yet, Beck

and Gergel observe that certain contexts support both presuppositions. As illustration serve sentences like (21).

(21)   *(Dust made the table dirty.) Peter wiped the table clean again.*

For one, *wiping* is a counterdirectional event to *dust moving onto the table*, but the context also supports the proposition *the table was clean before*. If contexts of use warranted the second kind of presupposition with sufficient frequency, hearers could hypothesize a new – repetitive – reading of *again*. By actualization, unambiguously repetitive uses would over time show up in the data.

These cases motivate Beck and Gergel's condition of *Constant Entailments*: In suitable common ground CG, two different syntactic-semantic structures S_1 and S_2 of sentence S can lead to the same information update: $CG \oplus [[S_1]] = CG \oplus [[S_2]]$. Both readings have the same entailments in CG. Yet, parts of S_1 and S_2 can differ in syntactic status and semantic content.[9] Beck and Gergel stress that this constellation, although similar in spirit to *bridging contexts* (Heine 2002, Diewald 2002 a.o.), builds on slightly different assumptions. While earlier literature stresses the importance of pragmatic strenghtening in order to enrich the content of words under change (König & Traugott 1988, Hopper & Traugott 1993), Beck&Gergel's Constant Entailment allow for change in parts without involving pragmatic enrichment. Their study argues that implicatures are *not* a necessary ingredient of semantic change by reanalysis.

Another prominent example of subtle semantic change is the Jespersen Cycle of negation. I take the big picture as known and illustrate the case schematically for French. Superficially, the sentences in (22) all state 'Pierre did not eat' with emphasis coming in (22b) and getting lost again.

(22)   a. *Pierre*   *ne*   *mange.*   old negation
        b. *Pierre*   *ne*   *mange*   *rien.*   emphatic
        c. *Pierre*   *ne*   *mange*   *rien.*   neutral bipartite negation
        d. *Pierre*   *mange*   *rien.*   loss of old negation
           Pierre   (neg)   eat   (neg)

(22a) corresponds to negation before and in Old French (OF) with a single negation word *ne* in preverbal position. (22b) at the OF stage is analysed as follows: The verb 'eat' combines with a determinerless object NP 'thing' to say 'Peter did not eat *a thing. Rien* in OF was used as negative polar item (NPI). We know this because *rien* was restricted to downward-entailing contexts and, unlike other noun phrases, *rien* in the NPI sense occured without determiner (Eckardt 2003, 2006). Following Krifka (1995), the word *rien* was a minimizer: Semantically, it restricts the verb 'eat' to eating events of smallest size. Pragmatically, the use of *Pierre eats rien* evokes alternative propositions that refer to larger events. These could have been negated instead, e.g. 'Pierre did not eat a small bit', 'Pierre did not eat a lot', 'Pierre did not eat a huge portion'.

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[9] See Stalnaker (2002) on common ground; Beck & Gergel (2015: (106), (106'), (107)) for more detailed schemes of reanalysis at the interface.

The utterance (22b) is the logically strongest among these alternatives. Krifka argues that this implicit comparison triggers the hearers' experience that "the negation is emphatic". Like all minimizers, OF *rien* has a complex lexical entry, combining semantic denotation and pragmatic content. Between stages (22b) and (22c), the pragmatic content of *rien* got lost and its distribution was now steered by syntax. In the data, we see that uses of *rien* in downward entailing contexts disappear, leaving only uses combined with negation *ne*. The lexical entry of *rien* in (22c) has hence lost the minimizer meaning. It is open whether the meaning of logical negation was still contributed by *ne* in (22c), whether *rien* adopted the denotation [[*rien*]] = λp.¬p or whether the meaning of negation comes in at an abstract NegP head, the presence of which is reflected by *ne* and *rien* (as Jäger and Penka (2011) propose for German). If we list the meanings of *rien* during these stages, we see that – *pace* Haspelmath – there is considerable meaning change involved.

(23) a. [[*rien*]] = 'thing' (cognate Lat. *res*)
      b. [[*rien*]] = λPλe(P(e) & 'e is minimal in P')
          Pragmatics: not-(P(e)-rien) is the strongest assertion (among salient alternatives) that the speaker could have made.[10]
      c. [[*rien*]] = λP.P (identity function; no own semantic content)
          Syntax: licensed by presence of *ne* via agreement (Zeijlstra 2005)
      d. [[*rien*]] = λp.¬p

This survey shows that the meaning of the 'reinforcer of negation' changes between stages in spite of the fact that all sentence meanings convey (almost) the same negative statement. While different languages arguably differ in the syntactic implementation of the Jespersen Cycle, the semantic record (23) remains valid for all cases described in the literature.

5. Limits of change and semantic universals

Investigations of syntactic change in terms of generative grammar have deepened our understanding of universals in syntactic structure (Roberts & Roussou 2003, van Gelderen 2011, Longobardi & Guardiano 2016, Biberauer et al. 2014, Biberauer et al. 2015). It is to be expected that the investigation of meaning change in terms of formal semantic will draw new links between semantic universals and the limits of language change. Schematically, semantic reanalysis consists in re-structuring the semantic composition of clauses while keeping the overall sense constant.

$$[[S]] = [[[α .. [β … γ ..] ..]]]^{old} = [[[α .. β … [… γ ..] ..]]]^{new}$$

While most word meanings remain constant, reanalysis allows to assume new meanings for selected words or constructions α in the clause. Here is an general version of (8) in section 1.

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[10] See (Krifka 1995, Eckardt 2006, 2012) for the full implementation of the pragmatic condition.

(24)   Solve the semantic equation: If you know [[S]] and the meanings of all words except α, you may assign α the necessary denotation needed to compute [[S]].

Possibly, though not necessarily, reanalysis can reshift pragmatic implicature into literal content. While König and Traugott (1988) emphasize pragmatic enrichment, Beck and Gergel (2015) point out that much change occurs under constant entailments in context, leaving the pragmatic contributions untouched.

The logical space of possible solutions in (24) is almost limitless, yet hypotheses on semantic universals in natural language entail effective limits to potential new meanings. Montague (1970) was the first to propose that every grammatical category in syntax corresponds to one logical type on the semantic side, such that, for instance, all verbs denote relations between (a small number of) entities and events; all nouns denote properties, and so on. While this view had to be softened somewhat, it is still embraced in spirit by semantic research.

Another prominent universal of determiner meanings in natural language was proposed by Barwise and Cooper who observed that all known natural language determiners seemed to "live on" the set contributed by the noun. This is captured by the following definition (Barwise & Cooper 1981, Keenan and Stavi 1986, Zimmermann and Hamm 2002):

(25)   Conservativity: A natural language determiner Q is conservative iff for any arguments A and B, Q(A,B) is true iff Q(A, A∩B) is true.

For instance, *every dog barked* is true if and only if *every dog is a dog and barked* is true. Therefore, *every* is conservative. Synchronic research since 1981 confirmed this property for all determiners in many languages (Keenan & Paperno 2012), which led to a hypothesized semantic universal for natural language determiners.

(26)   All natural language determiners are conservative.[11]

One potential counterexample to (26) are exclusives like *only*. *Only dogs bark* is true iff there are no non-dogs that bark—and hence the non-dogs do matter to determine the truth of the sentence. However, there are good reasons to assume that *only* in ModE, as well as its synonyms in other languages, must be analysed as focus sensitive particle. For example
- *only*-words can be combine with full DPs—while determiners normally cannot be stacked onto other determiners
- they can combine with non-nominal constituents—which determiners can not (Rooth 1985)
- they must mandatorily associate with focus—which determiners can, but do not have to (Beaver and Clark 2008)
- their position in sentences is restricted by the position of the associated focus (Büring 2016)
- they have the same meaning in all positions where they can be used (Rooth 1985).

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[11] Syntactically, determiners are roughly characterized as words that turn nominals into a major clausal constituent that, among other, can form a sentence in combination with a verb.

Beaver and Clark (2008) report that the mandatory association of *only* with focus in English is shared by all translation equivalents in other languages that were investigated (see also Aboh et al. 2007, Grubic and Zimmermann 2011). In particular, they found no counterparts of *only* that shared the syntactic status of determiners. Given that both focus particles and determiners are functional words and derive from earlier content words by grammaticalization, it is noteworthy that the multiple pathways of change never lead to a candidate *only* with the syntactic status of determiner.

In order to add depth to this question, I will take a closer look at the history of German *nur* 'only' (Eckardt and Speyer 2015). *Nur* goes back to exceptive markers *newan/ne wâri* that could be glossed as *wouldn't it be…* and that are attested in data similar to the use of English exceptive *but* (von Fintel 1993, Gajewski 2013). Notably, they share the restriction of *but* to certain licensing contexts, including negative contexts. Here is an example.[12]

(27) *mih   nieuuetes ne   lustet   neuuâre   sinero   anasune.*
      me   nothing   not   desires   <nur>   his   one-son
      Willeram's Hohes Lied Salomonis, 11 century; 5.6. After Graff and Massmann (1834: LXXII)
      'I desire nothing <u>but</u> his one and only son'

In this case, *neuuâre* has an overt correlate in the clause, the DP *nieuuetes.* In other cases, the exceptive can restrict the main clause without a correlate.

(28) *noch von   der   stat   niender chomen*
      nor   of   the   place   noway   come
      <u>niuwan</u> als   man   mich   truoc
      <nur> when one   me   carried
      '(I could not move) nor get away from that place unless one carried me'
      Konrad von Heimesfurt: diu urstende (c. 1230).

English *except* can be used in the same way.

(29) *I could not get away <u>except</u> when I was carried.*

Semantic analysis reveals that in such cases, the entire clause serves as the correlate: The negation *not* denies the existence of possible events of me getting away, *to the exception* of those where I was carried. A turning point was reached with examples such as (30).

(30) *Si **en**kunnen **niewan** triegen vil   menegen kindèschen*
      they not-can   <nur>   betray   many   several   childish
      man
      man
      'They can **not but / only** betray many innocent men'

The *niewan*-constituent in (30) has neither semantic nor syntactic correlates in the main clause. The main clause verb *kunnen* 'can' lacks a complement. It

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[12] Orthographic variants of *nur* are glossed as <nur>.

would be most natural to construe the VP 'betray many innocent men' as complement of *kunnen*, newly associated with emerging *niewan*.

Searching for historical uses of *niewan* to establish the pathway towards *nur*, linguists are often biased towards examples that match the eventual outcome of the development. Less attention is paid to early uses that might have initiated a reanalysis in terms of a determiner. Potential cases are examples where <nur> precedes a noun phrase.

(31) *neoman   nist   guot,   **nibi**   ein   got*
nobody   not-is   good   <nur>   one/unique   god
'nobody is good except the unique god'
(Tatian, DDD Tat106)

(32) *Tára   zû   diu   chínt   nehéin   núzze   sínt.*
there   to   the.pl child.pl not.one   use   are
***núbe** frûote liute*
<nur> wise   people
(In order to debate at the thing:) 'For that purpose, children are of no use, only wise people.'
(Notker, DDD Boethius_de_consolatione_philosophiae II)

The phrase *nibi ein got* in (32) would in principle fit the syntactic structure in (33), assuming an entry for *nibi* as determiner with meaning *only*.

(33)   [$_{DP}$ *nibi* [$_{NP}$ [*ein$_{adj}$*] *got$_N$*]].

Likewise, the elliptic clause in (32) has the intended content "only wise people are of use". A obvious possible way of attributing sense and structure to it could have been this:

(34)   [[sínt núzze]] = VP
[[frûote liute]] = NP
[[núbe]] = λPλQ (Q ⊂ P)

(35)   Composition of *nube* and NP
λQ (Q ⊂ [[frûote liute]])
Composition with VP
([[sínt núzze]] ⊂ [[frûote liute]])

The analysis in (35) yields the truth conditional content 'that all those who are of use (for the purpose) are wise people' — in other words, only wise people are of use. The data record thus shows that potential bridging contexts would have allowed to construe a determiner *nur* — violating conservativity. In actual fact, *nur* never took this route. This means that speakers' search for novel solutions of the semantic equation are restricted by the conservativity universal. The following dynamic version of conservativity is in effect.

(36)   Dynamic conservativity:
If in the analysis of an example, you assume that word α denotes a

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quantifier Q with nominal complement A and second argment B,
then Q(A,B) must be true iff Q(A, A∩B) is true.

Dynamic conservativity will exclude a determiner that means *only*.

The balance between semantic universals and language-specific features is also at the heart of Beck's (2019) survey of universals. Beyond Conservativity, she proposes the following (non-comprehensive) range of semantic operations to be available in *all* natural languages (see also von Fintel & Matthewson 2008).

- Functional application (operators combining with arguments of suitable logical type)
- coordinative modification (modifiers add properties in conjunctive, never in disjunctive way)
- property abstraction (a formal operation that amounts to "freezing" the combination of operators and arguments)
- computation and use of Alternatives in focus and question semantics

Looking at diachronic research through the glasses of a semanticist, it seems that these operations are in fact tacitly adopted by all diachronic discussion of historical data, be it in informal or formal frameworks. This scholarly practice is justified by the Uniformitarian principle (Walkden 2019), as any language stage that gave away one or more of these principles would in fact look fundamentally different from any living language that has ever been investigated.

Beck points out that languages can differ from one another in the semantic means at use, and offers a survey of semantic operations that she calls *parameters:* Principles that are available in some, but not all languages *L*. For instance, some languages (like English) provide an interpretation principle to derive resultatives, whereas other languages do not.

(37)   a. *John hammered the can flat.* "John did some hammering that caused the can to become flat"
b. *Jean a martelé la boîte plate.
unavailable: Jean did some hammering that caused the can to become flat.

Beck illustrates a wider range of parameters, including interpretation of resultatives, of N-V incorporation; the availability of gradable predicates; the use of Alternatives beyond the realm of focus/questions; the use or absence of epistemic markers; the use or absence of discourse configurational syntax; availability of LF movement (which one could loosely paraphrase as "the number and range of scope ambiguities") as well as concord phenomena (past tense concord, negative concord, modal concord). Beck's list is non-comprehensive, but it seems worthwhile to investigate the role of language specific semantic operations in language change. Plausibly, an established operation may facilitate the emergence of analogous constructions. In the long run, languages can also lose language-specific composition patterns: Eckardt and Walkden (2022) argue that OE *whether* questions made use of Alternative Semantics in ways that are no longer available in ModE. This suggests that the changes in English between 800 and 1200 were substantial, changing the

range of available semantic operations. The emergence and loss of semantic operations is a domain of diachronic research that awaits systematic exploration.

6. Conclusion

This article introduced the basic ideas and assumptions for diachronic research in formal semantics. Formal semantics is devised to describe the logical and compositional structure of words, phrases and sentences in natural language. The theory can therefore trace changes in composition and meaning with greater explicitness and precision than competing frameworks.

Greater precision earns us further benefits. Precise assumptions about the logical structure of competing terms in paradigms can help to formulate hypotheses about the pragmatic competition between words, which in turn explains directionality of developments and seemingly random gaps in the data record. Precise tracking of presuppositions reveals semantic bleaching as loss in presuppositions, triggered by pragmatic overload.

Central to formal diachronic semantics is the idea of "solving semantic equations". This process explains how a word's newer sense can differ substantially from the older one, when the word is reinterpreted so as to provide the missing link towards the understood sentence meaning. The new solutions of semantic equations may stray far from the word's older meaning, but they are still restricted by powerful universals that drive speakers' interpretation in language change.

The summaries of research papers focussed on major claims and ideas of the respective works. In order to experience formal diachronic semantics in action, Beck and Gergel's (2015) paper on *again* as well as Yanovich's (2016) discussion of OE modals might offer an accessible entry point. Eckardt (2006) includes the semantic tools and notations needed for the case studies in question, aiming to be self-contained – but I am unable to say whether the monograph achieves this goal.

References

Aboh, Enoch, Katharina Hartmann and Malte Zimmermann (eds.). 2007. *Focus Strategies in African languages: The Interaction of Focus and Grammar in Niger-Congo and Afro-Asiatic*. Berlin: Mouton de Gruyter.
Barwise, John and Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4(2), 159 – 219.
Beaver, David I. and Brady Z. Clark. 2008. *Sense and Sensitivity.* Wiley Blackwell *Explorations in Semantics* Series.
Beck, Sigrid and Gergel, Remus. 2015. The diachronic semantics of English *again*. *Natural Language Semantics* 23(3): 157–203.
Beck, Sigrid. 2019. Semantic Parameters and Universals. In Daniel Gutzmann, Lisa Matthewson, Cécile Meier, Hotze Rullmann, and Thomas Ede Zimmermann (eds.) *The Wiley Blackwell Companion to Semantics.* Wiley-Blackwell.

Biberauer, T., A. Holmberg & I. Roberts. 2014. A Syntactic Universal and its Consequences. *Linguistic Inquiry* 45:169-225.

Biberauer, T. & I. Roberts. 2015. The Clausal Hierarchy, Features and Parameters. In U. Shlonsky (ed) *Beyond Functional Sequence: The Cartography of Syntactic Structures, Volume 10*. Oxford: Oxford University Press, 295 – 313.

Büring, Daniel. 2016. *Intonation and Meaning.* Oxford University Press.

Condoravdi, Cleo and Ashwini Deo. 2015. Aspect shift in Indo-Aryan and trajectories of semantic change. In Chiara Gianollo, A. Jäger, D. Penka (eds.) *Language change at the syntax-semantics interface.* Berlin: DeGruyter Mouton, 261 – 292.

Diewald, Gabriele 2002. A model for relevant types of contexts in grammaticalization. In: I. Wischer & G. Diewald (eds.). *New Reflections on Grammaticalization.* Amsterdam: Benjamins, 103–120.

Deo, Ashwini. 2015. The semantic and pragmatic underpinnings of grammaticalization paths: The progressive to imperfective shift. *Semantics and Pragmatics* 8(14): 1–52.

Dowty, David. 1977. Toward a semantic analysis of verb aspect and the English "imperfective" progressive. *Linguistics and Philosophy* 1(1), 45 – 77. http://dx.doi.org/10.1007/BF00351936.

DW: Grimm, Jakob and Grimm, Wilhelm (eds.) 1854-1960. Deutsches Wörterbuch. S. Hirzel, Leipzig. Available online.

Eberhardt, Ira. 2017. From a focus particle to a conjunction: Diachronic and synchronic analysis of German *zumal*. *Language* 93(2), 66 – 96.

Eckardt, Regine. 2001. Reanalysing selbst. *Natural Language Semantics* 9, 371 – 412.

Eckardt, Regine. 2003. *Eine Runde im Jespersen-Zyklus: Negation, emphatische Negation, negative-polare Elemente im Altfranzösischen.* Internet-Publikation KOPS (Konstanzer Online-Publikations-Sytem), http://www.ub.uni-konstanz.de/kops/volltexte/2003/991.

Eckardt, Regine. 2006. *Meaning change in grammaticalization. An enquiry into semantic reanalysis.* Oxford: Oxford University Press.

Eckardt, Regine. 2009. APO: Avoid Pragmatic Overload. In Jacqueline Visconti, Maj-Britt Mosegard Hansen (eds.) *Current Trends in Diachronic Semantics and Pragmatics.* London, Emerald: 21 – 42.

Eckardt, Regine 2010. Language Change and Semantic Reanalysis. In *Language and Linguistic Compass. An Online journal.* Blackwell Wiley, Oxford: 1 – 14.

Eckardt, Regine. 2012. The many careers of negative polarity items. In: Kristin Davidse, Tine Breban, , Liselotte Brems und Tanja Mortelmans (eds.): *Grammaticalization and Language Change: New Reflections.* Amsterdam/Philadelphia: John Benjamins, pp. 299 – 326.

Eckardt, Regine and Augustin Speyer. 2015. Information Structure and Language Change. In Caroline Féry, Shinichiro Ishihara (eds.): *Handbook of Information Structure.* Oxford, Oxford University Press: 503 – 522.

Eckardt, Regine and George Walkden. 2022. A particle-like use of *hwæþer*. Wisdom's questions in Boethius. In Xabier Artiagoitia, Sergio Monforte & Arantzazu Elordieta Alcibar (eds.), *Discourse particles.Their Syntax, Meaning and Diachrony*. Amsterdam, John Benjamins., John Benjamins. t.a.

Edmondson, Jerold A. und Frans Plank. 1978. Great Expectations: An intensive *self* analysis. In *Linguistics and Philosophy* 2, 373-413.

von Fintel, Kai & Lisa Matthewson. 2008. Universals in Semantics. *The Linguistic Review* 25 (1-2), 139-201.

von Fintel, Kai. 1993. Exceptive constructions. *Natural Language Semantics* 1,123 -148.

von Fintel, Kai and Irene Heim. 2007. *Intensional Semantics.* MIT. Online at http://semantics.uchicago.edu/kennedy/classes/s08/semantics2/vonfintel+heim07.pdf

Gajewski, Jon. 2013. An analogy between a connected exceptive phrase and polarity items. In Csipak, Eva, Regine Eckardt, Mingya Liu + Manfred Sailer (eds.) *Beyond ,any' and ,ever'.* Berlin, Mouton deGruyter.

van Gelderen, Elly. 2011. *The Linguistic Cycle: Language Change and the Language Faculty*. Oxford: Oxford University Press.

Graff, Eberhard G. and Hans F. Massmann. 1834. *Althochdeutscher Sprachschatz.* Berlin: Nicolai. Available at Google Books.

Grubic, Mira and Malte Zimmermann. 2011. Conventional and free association with focus in Ngamo (West Chadic). In I. Reich et al. (eds.), *Sinn und Bedeutung 15*.

Haspelmath, Martin. 1999. Why is grammaticalization irreversible? *Linguistics* 37(6), 1043 – 1068.

Heim, Irene & Angelika Kratzer 1998. *Semantics in Generative Grammar*. Oxford: Blackwell.

Heine, Bernd 1997. Grammaticalization and language universals. In A. Lemarechal (ed.), Grammaticalisation et reconstruction. (Mémoires de la Société de Linguistique de Paris, Nouvelle Série, 5.) Paris: Klincksieck. Pp. 11-23.

Heine, Bernd 2002. On the role of context in grammaticalization. In Wischer, Ilse & Gabriele Diewald (eds.) 2002. *New reflections on grammaticalization.* Amsterdam, Philadelphia: Benjamins, 83 – 101.

Heine, Bernd and Tanja Kuteva. 2002. *World Lexicon of Grammaticalization.* Cambridge: Cambridge University Press.

Hopper, Paul J. and Elizabeth C.Traugott. 1993. *Grammaticalization*. Cambridge: Cambridge University Press.

Jäger, Agnes and Doris Penka. 2012. Development of sentential negation in the history of German. In Peter Ackema et al. (eds.), *Comparative Germanic Syntax: The state of the art.* Amsterdam: John Benjamins, 199 – 222.

Keenan, Edward and Jonathan Stavi. 1986. Semantic Characterization of Natural Language Quantifiers. In *Linguistics and Philosophy* 9: 253 - 326.

Keenan, Ed and Denis Paperno (eds.). 2012. *Handbook of Quantifiers in Natural Language.* New York, Berlin: Springer.

König, Ekkehart & Elisabeth C. Traugott 1988. Pragmatic strengthening and semantic change: The conventionalizing of conversational implicature. In: W. Hüllen & R. Schulze (eds.). *Understanding the Lexicon: Meaning, Sense and World Knowledge in Lexical Semantics*. Tübingen: Niemeyer, 110–124.

König, Ekkehard and Peter Siemund. 1996. Emphatische Reflexiva und Fokusstruktur: Zur Syntax und Bedeutung von 'selbst'. In: I. Rosengren (ed.) *Sprache und Pragmatik* 40. Lund, Gleerup: 1-42.

Kratzer, Angelika. 2012. *Modals and conditionals.* Oxford University Press.

Krifka, Manfred. 1995. The semantics and pragmatics of polarity items. *Linguistic Analysis* (25), 209 – 257.

Levinson, Stephen. 2000. *Presumptive Meanings*. Cambridge: Cambridgen University Press.

Longobardi, Giuseppe. 2001. Formal syntax, diachronic minimalism and etymology. In *Linguistic Inquiry* (32.2): 275 - 302.

Longobardi, Giuseppe and C. Guardiano. 2016. Parameter theory and parametric comparison. In Roberts, I. (ed.) *The Oxford Handbook of Universal Grammar.* Oxford University Press, pp. 377 – 401.

Lucas, Christopher and David Willis. 2012. *Never* again: The regrammaticalization of *never* as a marker of negation in English. *English Language and Linguistics* (16), 459 – 485.

Matthewson, Lisa. 2013. Gitskan Modals. *International Journal of American Linguistics* (79), 349 – 394.

Montague, Richard. 1970. English as a Formal Language. In: Bruno Visentini (ed.): *Linguaggi nella società e nella tecnica*. Mailand 1970, 189–223. Reprinted in Thomason, 1974: *Formal Philosophy. Selected Papers by Richard Montague.* New Haven.

Opitz, Martin 1978. *Gesammelte Werke: Kritische Ausgabe. Bd. II: Die Werke von 1621 bis 1626*. George Schulz-Behrend (ed.). Stuttgart: Anton Hiersemann Verlag.

Partee, Barbara H. 1989. Many quantifiers. In J. Powers, K. de Jong (eds.), ESCOL 89: Proceedings of the Eastern States Conference on Linguistics. Ohio State University. Reprinted in Partee, Barbara H. 2004. *Compositionality in Formal Semantics: Selected Papers by Barbara H. Partee.* Oxford: Blackwell Publishing, 241-258.

Penka, Doris. 2007. Uninterpretable Negative Features on Negative Indefinites. In: Maria Aloni, Paul Dekker and Floris Roelofsen (Eds.) *Proceedings of the 16th Amsterdam Colloquium*. Amsterdam, ILLC/Department of Philosophy.

Peterson, Tyler. 2010. *Epistemic Modality and Evidentiality in Gitksan at the Semantics-Pragmatics Interface.* PhD Dissertation. UBC

Portner, Paul. 2005. What is Meaning? Fundamentals of Formal Semantics. Malden, Blackwell.

Rullmann, Hotze, Lisa Matthewson, and Henry Davis. 2008. Modals as Distributive Indefinites. *Natural Language Semantics* (16), 317 – 357.

Roberts, Ian and Anna Roussou. 2003. *Syntactic change. A minimalist approach to grammaticalization.* Cambridge: Cambridge University Press.

Rooth, Mats. 1985. *Association with Focus.* Dissertation, University of Massachusetts at Amherst.

Schaden, Gerhard. 2020. Latin UNUS and the discourse properties of unity cardinals. *Canadian Journal of Linguistics* 65, 438 – 470.

Traugott, Elizabeth C. 2006. The Semantic Development of Scalar Focus Modifiers. In Ans van Kemenade, B. Los (eds.) *The Handbook of the History of English.* Malden, Blackwell: 335 - 359.

Traugott, Elizabeth C. 2008. The grammaticalization of NP of NP constructions. In Alexander Bergs and Gabriele Diewald (eds.), *Constructions and Language Change* . Berlin/New York: Mouton de Gruyter, 21 – 43.

Traugott, Elizabeth C. and Richard B. Dasher. 2002. *Regularity in semantic change.* Cambridge, Cambridge University Press.

Walkden, George. 2019. The many faces of uniformitarianism in linguistics. *Glossa: A Journal of General Linguistics*. 4 (1): 52. doi:10.5334/gjgl.888.

Yanovich, Igor. 2016. OE *motan, variable-force modality, and the presupposition of inevitable actualization. *Language* 92(3), 489 – 521.

Zeijlstra, Hedde. 2005. *Sentential Negation and Negative Concord.* PhD dissertation, University of Amsterdam.

Zimmermann, Ede and Fritz Hamm. 2002. Quantifiers and Anaphora. In: Zimmermann, E. and Hamm, F. (eds.): *Semantics. Special Issue of Linguistische Berichte.* 137 – 172.