

Unifying TENSE, ASPECT and MODALITY across languages

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Abstract

This paper computes the semantic representation of *while* as the pragmatically most relevant one which speakers select from a variety of grammatical constructions in which *while* may occur in current English. The semantic representation of *while* provides the condition for translating it into the adequate German equivalent. This computation is implemented in a unification-based formalism and may thus be applied in a machine translation system.

1 Introduction

This paper analyzes the semantics of *while* as reflecting the grammaticalization of its TEMPORAL meaning. While grammaticalization is generally studied as the linguistic change from more lexical to more grammatical form and meaning, our investigation is concerned with the synchronic variation between lexically autonomous and contextually dependent meaning with the current use of English *while* and its translation into German. This view on grammaticalization allows the typological study of a variety of grammatical functions across languages (Hopper and Traugott, 1993, 90). From a typological point of view we are particularly interested in the persistence of grammaticalization. In the ideal case we may observe how different grammatical functions of the same form are synchronically constrained by their lexical sources (Hopper and Traugott, 1993, 120).

Consider the following cross-language comparison of verbs which express the lexical sense of a DIRECTIONAL MOTION alongside with the grammatical sense of the FUTURE:

- (1) English: *to be going to, to come*
- (2) German: *gehen, kommen*
- (3) French: *être en train de, aller faire*
- (4) Spanish: *ir a*

The lexical meanings of these MOTION verbs co-exist with the grammatical meaning of the FUTURE. The domain of SPACE provides the lexical source of the grammatical domain of TIME (Bybee et al., 1994, 269). This is an obvious extension from more lexical to more grammatical categorization which speakers create by a change from one domain to another and it is therefore a metaphorical extension. In this metaphorical transfer the domain of SPACE provides a model for the domain of TIME. The periphrastic constructions in (1) to (4) provide evidence for this direction of development, which has been attested for a wide number of languages (Bybee et al., 1994). Yet, the TEMPORAL sense represents a conversational implicature of the SPATIAL sense as SPATIAL MOTION logically presupposes EXTENSION through TIME. This grammaticalization by metaphorical transfer reduces the speakers' reference from reference to SPATIAL AND TEMPORAL DIRECTION to reference to TEMPORAL DIRECTION. The semantic reduction strengthens the informativity and relevance of the TEMPORAL meaning (Hopper and Traugott, 1993, 65). Yet the general semantic schema of a DIRECTION FROM SOURCE TO GOAL is preserved in this transfer.

As may be seen with the above given examples, the same series of semantic transitions or “clines” reoccur with different lexical units both within one and the same language, as with the English MOTION verbs *go* and *come*, and across languages, as with the equivalents *go* in English, *gehen* in German, *aller* in French and finally *ir* in Spanish. These clines are also similar across languages which are areally and genetically unrelated. The claim is therefore that these clines are universal and in most cases irreversible pathways of semantic change, that is we cannot observe speakers to be involved in a semantic extension from the domain of TIME to the domain of SPACE. This is the universal cognitive principle of unidirectionality (Hopper and Traugott, 1993, 1,6); (Bybee et al., 1994, 19,300). This paper will provide a theory about unidirectionality from the perspective of cognitive linguistics which will be evaluated and formalized by the grammaticalization cline of *while*. Finally we will discuss which implications the grammaticalization cline of *while* has for a our theory of unidirectionality.

2 Formalization and translation

We will compute the semantic representation of *while* as the pragmatically most relevant one which speakers select from a variety of grammatical constructions in which *while* may occur in contemporary English. The different uses of *while* form a cline from relatively free to bound meaning. The meanings of this cline are represented by a componential analysis, which provides the condition for translating *while* into the adequate German equivalent. We analyse the use of *while* in terms of several grammatical and semantic components:

1. grammatical categories
2. grammatical domains
3. image schemata which represent domains metonymically and which are transferred across domains metaphorically

The semantic representations of *while* are implemented in a unification-based formalism as introduced by Martin Kay (1985) and may thus be used in a machine translation system. According to Langacker (1991, 532) the categorization of

an expression’s meaning occurs by its integration into the contextually related schemata. In this unification an expression’s meaning is constrained by the schemata of other functions. The composition of a composite structure may thus be represented by a unification-based model *par excellence* (Zelinsky-Wibbelt, 2000). In terms of this formalism composition occurs through the unification of attribute-value structures. At each level these structures consist of an attribute on the left-hand side and a value on the right-hand side:

$$\left[\begin{array}{l} \text{LU} \quad \text{V} \boxed{\square} \\ \text{N} \quad \left[\text{T} \quad \text{A} \boxed{\square} \right] \end{array} \right]$$

In this schematic attribute-value matrix the lexical unit LU is the only variable specified by a simplex value V. The attribute LU is conjoined by the attribute N, N being paired with the complex value consisting of the attribute-value pair T A. Integers represent the inheritance from free to bound categories.

In accordance with Gutt (1991, 189), we claim that translators produce an equivalent target language text by following the principle of relevance. As communication in general translation involves the comparison of interpretations as a universal disposition of human reasoning (Sperber and Wilson, 1995, 46ff.). In order to agree in their interpretations, speakers negotiate their mental representations by recognizing the relevant information with minimal cognitive cost and maximal cognitive benefit.

3 Clines between grammatical categories

On account of its intension *while* is part of a cline of the grammatical categories from more lexical to more grammatical meaning in the following order:

$$\text{N} > \text{V} > \text{ADJ} > \text{ADV} > \text{PREP} / \text{CONJ}$$

Clearly nouns are lexically richer in meaning than verbs, that is the intension of nouns is lexically more autonomous, as verbs are contextually dependent on the semantic values of the arguments which they lexically expect or contextually require (Langacker, 1987; Gentner, 1981). This means that the senses of verbs are less constrained by their own attributes. Instead their attributes

function as variables which unify with the values of the arguments which provide the grammatical context.

Psycholinguistics accounts for this intensional difference between nouns and verbs by the **natural partitions hypothesis** about the speakers' spatial conceptualization. Nouns correspond to relatively stable concepts and verbs, adjectives, adverbs, prepositions and conjunctions correspond to more variable concepts. The stability of nominal concepts results from **object permanence**. The notion of object permanence has been introduced by Piaget (1972) as the child's ability to represent an object permanently, independently of its physical existence. Object permanence as a condition for conceptual stability implies the **persistence** of the object's attributes which are **internally cohesive**, that is densely interrelated. Furthermore, the stability of nominal concepts results from **external boundedness**. All of these properties adhere less to the concepts of verbs on account of their contextual variability (Imai and Gentner, 1997, 193). Verbal and prepositional concepts have less internal relations between attributes than nominal concepts. Instead verbs, prepositions and conjunctions have external relations to the parts of speech they interrelate (Zelinsky-Wibbelt, 1990).

The extensional variations of verbal concepts explain that they are harder to learn, to remember, to produce and to comprehend.

The context-dependent concepts of verbs, adjectives, prepositions, and conjunctions are also less similar across languages than the more autonomous concepts of nouns (Zelinsky-Wibbelt, 1993).

(5) *The bottle floated into the cave.*
MANNER DIRECTION

⇒

La botella entró la cueva, flotando.
DIRECTION MANNER

(Talmy, 1978)

Whereas in English the MOTION verb *float* expresses MANNER and the preposition *into* DIRECTION, this is reversed in Spanish, where the verb *entrar* expresses DIRECTION while the adverbial phrase *flotando* expresses MANNER. On account of their extensional consistency trans-

lators also take nouns to contribute more to their interpretation of a text than other grammatical categories (Königs, 1993, 233f.).

In comparison to verbs adjectives are semantically even more dependent on the nouns which they modify and from which they inherit their specific value. In (6) the lexically vague meaning of the adjective *high* is contextually graded on a scale by the specific size which is a component of the lexical concepts of *heel* and *tower*:

(6) *high heel, high tower*

To summarize: the contextual and cross-linguistic semantic variability increases from nouns to verbs over adjectives to prepositions and conjunctions (Gentner, 1981, 176).

With the senses of *while* it is most evident that they are related in a grammaticalization cline in the above pathway with the noun at the lexical pole and the conjunction at the grammatical pole.

4 Clines between grammatical domains

Each grammatical category is organized in a cline of grammatical domains. Thus the cline of *while* may be represented in a semantically more finegrained way with the comparison of the different grammatical domains of MODALITY, TENSE and ASPECT. Bybee (1994, 22ff., 300ff.) claims this order of domains to be universally valid by drawing on extensive cross-language statistical analyses. She also correlates this cline of grammatical domains with the order in which the morphemes expressing the domains of MODALITY, TENSE and ASPECT are arranged around the verb stem: the proximity of these morphemes to the verb correlates with the degree to which they influence the meaning of the verb, for which Bybee introduces the term "semantic relevance". Semantic relevance is also signalled by the degree of morphologization:

MODALITY > TENSE > ASPECT

(7) *She might be telling the truth.*
TENSE ASPECT
MODALITY

The domain of ASPECT most directly influences the verb meaning by representing the internal constituency of the situation in relation to the

speech time (Hopper and Traugott, 1993, 142ff.); (Comrie, 1976) and by the morphological fusion manifested by the *-ing* inflection of the verb in (7). The domain of TENSE is less relevant to the verb as it expresses how the EVENT TIME is related to another TIME, either to SPEECH or REFERENCE TIME. MODALITY is even less relevant to the verb, and thus least grammatical in our comparison, as is evident from the word order in (7) in which the MODAL form of *might* is most distant from the verb stem. EPISTEMIC MODALITY represents the speakers' evaluation of the truth of the proposition. DEONTIC MODALITY represents the VOLITION which speakers impose on the situation expressed by the proposition.

5 Clines through metonymy and metaphor

Each grammatical domain is organized through metonymy and metaphor. Both semantic extensions are two complementary stages of the same problem-solving activity (Heine et al., 1991, 49); (Croft, 1993). Metonymy is a semantic extension within the same domain of discourse:

(8) *We had a glass or two.*

In (8) the noun phrase *a glass* represents an elliptical construction of e.g. *a glass of wine*. In the discourse domain of DRINKING the two contingent objects *glass* and *wine* embody the image-schema of CONTAINER and CONTENT (Lakoff, 1987, 272f.). (8) exemplifies a metonymic extension, where the CONTAINER represents the CONTENT. Each metonymy embodies at least two parts of a schema, such as CONTAINER and CONTENT.

6 Grammaticalization paths of *while*

A grammaticalization cline initially proceeds metonymically by semantic reduction within the same domain. In this way the TEMPORAL meaning of the noun *while* has become reduced to the grammatical meaning of a conjunction within the same domain. Prerequisite of this metonymic bleaching is the previous semantic reduction of the lexical meaning, which is the case with the noun *while*. Intensionally the noun *while* is related to the vague concept of a CONTAINER in the

domain of TIME. With this lexically vague concept *while* is very untypical of the grammatical category of nouns as content bearers within our cline of grammatical categories. Yet, grammatically the noun *while* has the autonomous qualities of nouns (Zelinsky-Wibbelt, 1988; Zelinsky-Wibbelt, 1992). It constrains the relational meanings of verbs, it can be determined and modified, and it can have co-referential functions, as it has in (9) (Hopper and Traugott, 1993, 104):

(9) *We waited for three hours, all the while hoping that someone would come and fetch us.* (Hornby and Crowther, 1995, OALD)

In example (9) the quantifying and identifying NP *all the while* refers anaphorically to the NP *three hours*, which specifies the reference time (REF TIME) from which the NP *the while* inherits the exact measure of its boundary. By inheriting this boundary, *the while* functions as the CONTAINER (CONTAIN) of the CONTENT which is expressed by the verb phrase *hoping that ...*. The PROGRESSIVE ASPECT (PROGRESS) of the form *hoping* is thereby bounded to what fits into the CONTAINER. This attribute-value representation is a condition for the corresponding German equivalent *Weile*:

<i>while</i>	[TIME CONTAIN \square]
<i>3 hours</i>	[REF TIME BOUND \square]
<i>waited</i>	[TENSE PAST]
<i>hoping</i>	[ASPECT PROGRESS \square]
<i>would come</i>	[TENSE PAST]
\Rightarrow <i>Weile</i>	

By its lexically vague and reduced meaning the noun *while* is metonymically related to the conjunction *while* within the same domain and context of discourse. Formally this is illustrated by deleting the referential functions of the determiner and the quantifier whereby the noun *while* turns into a conjunction.

(10) *We waited for three hours, while [we were] hoping that someone would come and fetch us.*

By this formal reduction *while* has lost all referential functions, it cannot be determined and quantified (Hopper and Traugott, 1993, 104), nor can it be modified or have co-referential functions. The anaphoric reference relation of the NP *the while* to

the NP *three hours* has changed to the grammatical relation of SIMULTANEITY (SIMULTAN) between two situations in TIME as expressed by the conjunction *while*. Semantically, *while* has lost the iconic function of a CONTAINER. Instead the conjunction *while* indexically interrelates other expressions in the context which provide the functions of CONTAINER and CONTENT. In (10) the conjunction *while* relates the nucleus as the CONTAINER to the adverbial clause as the CONTENT (Langacker, 1991, 424ff.). The TEMPORAL situation expressed in the adverbial clause is within the scope of the situation expressed in the nucleus by the predication of the ACCOMPLISHMENT (ACCOMPL) verb *wait* and the NP *three hours* specifying the reference time. Thereby the reference time defines the length of the SIMULTANEITY. In these relations the SIMULTANEITY sense of *while* is computed from two conditions: firstly, both clauses need to express the same TENSE value. Secondly there has to be partial or complete TEMPORAL overlap between the two situations.

Cognitively, the metonymic reduction to the grammatical meaning increases the schematic semantic structure of *while* and improves the recognition of the relevant information in the discourse domain of TIME. This configuration of the TEMPORAL meaning of the conjunction *while* provides a condition for the German equivalent *während*:

<i>while</i>	[TIME SIMULTAN 1 2]
<i>waited</i>	[BOUND ACCOMPL 2 TENSE PAST 1]
<i>three hours</i>	[REF TIME BOUND 2]
<i>hoping</i>	[ASPECT PROGRESSIVE 2]
<i>would come</i>	[TENSE PAST 1]
⇒ <i>während</i>	

If we compare (9) to (10), we can now locate *while* at the two opposite poles of the cline between grammatical categories: the noun *while* as a content word is lexically most autonomous in its meaning and thus is ordered at the leftmost end of the cline, whereas the conjunction *while* is intensionally most reduced and extensionally most dependent on the content words it interrelates and thus is ordered at the rightmost end of the cline.

By this metonymic representation the TEMPORAL domain is organized in terms of image

schemata in a way which is cognitively relevant enough for the metaphorical transfer of these image schemata into a different target domain. The TEMPORAL sense of the conjunction *while* is semantically related to two metaphorical extensions in the domain of MODALITY (MODAL). The SIMULTANEITY between two situations is related to the ADVERSATIVE CONCESSIVE (ADVERS CONCESS) sense relating two antonymous situations. In (11) *while* expresses the ADVERSATIVE relation, in that the adverbial clause asserts the opposite of the nucleus (Heine, 1997, 116f.); (Bybee et al., 1994, 225). The ADVERSATIVE sense of WHILE is a lexicalization from the speakers' conversational implicature of an ANTONYMY (Grice, 1975). The SIMULTANEITY between two different situations supports this implicature if it is communicatively relevant (Traugott and König, 1991, 201), thereby again strengthening the informativity and the relevance of the conjunction *while*. In this metaphorical transfer the abstract structure of the image schema has been preserved. SIMULTANEITY is the result of comparing two situations in the domain of TIME. The ADVERSATIVE relation results from contrasting two situations in the domain of MODALITY:

(11) *While this is an attractive theory there is little or no contemporary evidence ... to support it* (ICE-GB:W1A-001 # 29:1)

In (11) the conjunction *while* juxtaposes EPISTEMIC CERTAINTY (CERTAIN) expressed by the positive mood in the adverbial clause with EPISTEMIC UNCERTAINTY (UNCERTAIN) expressed by the negative mood in the nucleus. From this contrast the ADVERSATIVE CONCESSIVE sense of *while* is computed which translates into the German equivalent *obwohl*:

<i>while</i>	[MODAL ADVERS CONCESS 1 2]
<i>attractive theory</i>	[MODAL EPISTEMIC CERTAIN 2]
<i>no evidence</i>	[MODAL EPISTEMIC UNCERTAIN 1]
⇒ <i>obwohl</i>	

While the TEMPORAL SIMULTANEITY sense of the conjunction *while* may be computed from the morphological functions of the verbs expressing the PROGRESSIVE ASPECT and the PAST TENSE which *while* relates in (10), the ADVERSATIVE sense of the conjunction *while* in (11) has to be

inferred from the discourse coherence relations between several semantic values imposing constraints on each other: the lexical units *theory* and *evidence* intensionally embody CERTAINTY of knowledge. This lexical value of *theory* is emphasized by the adjectival modifier *attractive* in the adverbial clause, while the lexical value of *evidence* in the nucleus is negated and downtoned by the modifying adjective *little*.

The other metaphorical sense of *while* which proceeds from the TEMPORAL domain draws on the scope which the predication of the nucleus clause has on the situation expressed in the adverbial clause in (10). This is the metaphorical concept of a CONCESSIVE relation presupposing a condition.

- (12) *In a few weeks the Fourteenth Household Division will be moving from Horse Guards here to a temporary home at Chelsea Barracks while Horse Guard's building is completely refurbished*
(ICE-GB:S2A-011 # 101:1:A)

In (12) the COMPLETIVE ASPECT expressed in the adverbial clause provides a boundary condition for the continuously extending OBLIGATION expressed in the nucleus and thereby induces the CONDITIONAL CONCESSIVE sense on *while*, which is translated into German *solange bis*. This computation needs even more compositional work to be done. The REFERENCE TIME expressed by the PP *in a few weeks* and the morphological function of *will* locate the situation in the FUTURE. The discourse coherence relation which the verbs *refurbish* and *move* adopt in the respective discourse domain induce the DEONTIC OBLIGATION (OBLIG) sense on *will* and the CONDITIONAL mood on the adverbial clause. This is consonant with Bybee's claim that the FUTURE is less a TEMPORAL than a MODAL category with important temporal implications (Bybee et al., 1994, 280).

<i>while</i>	[MODAL CONDIT CONCESS [1] [2] [3]]
<i>will be moving</i>	[DEONTIC OBLIGATION [3] REF TIME FUTURE ASPECT CONTINUOUS]
<i>is completely refurbished</i>	[ASPECT COMPLETIVE [2] MOOD CONDITION [1]]
⇒ <i>solange bis</i>	

In (12) the general image schema is preserved by the conjunction *while* in the domain of MODALITY in two respects: firstly, the CONDITIONAL CONCESSIVE sense presupposes partial or complete TEMPORAL overlap between the situations expressed in both clauses. Secondly, the boundary condition of the COMPLETIVE ASPECT is schematically isomorphous with the scope of predication, which the ACCOMPLISHMENT verb of the nucleus has on the TEMPORAL meaning of the adverbial clause in (10).

The schema of the CONDITIONAL CONCESSION sense of *while* in the domain of MODALITY is metonymically closely related to the CAUSAL sense. In the following example the CAUSAL sense of *while* may be computed from relating the CONDITION (CONDIT) expressed in the adverbial clause to the CONSEQUENCE (CONSEQU) expressed by the indirect IMPERATIVE speech act of the nucleus:

- (13) *While you're in the kitchen, bring me another drink.* (Quirk et al., 1985, 15.46)

<i>while</i>	[MODAL CAUSAL [1] [2]]
<i>bring</i>	[CONSEQU IMPERATIVE [2]]
<i>be in</i>	[CONDIT EPISTEMIC CERTAIN [1]]
⇒ <i>weil</i>	

The transfer in the domain of MODALITY has preserved the basic structure of the image schema. The DEONTIC OBLIGATION uttered with respect to the FUTURE in the nucleus in (12) corresponds to the DEONTIC OBLIGATION uttered in the indirect IMPERATIVE speech act of the nucleus in (13). Moreover the CAUSAL sense of *while* presupposes TEMPORAL overlap between the CONDITION and the CONSEQUENCE. This is to say, that the CAUSAL sense is intended as a conversational implicature in (12).

This sense of *while* is not lexicalized. We did not find it in our corpus, nor in any monolingual dictionary. Yet, it is used in contemporary English and may be hypothesized to be indicative of the ongoing dynamics of English typically promoted at the colloquial level of speech. In (13) the informal style becomes evident from the contradiction involved in the SIMULTANEITY between the addressee's SPATIAL presence and absence. This non-monotonic reasoning is less typical of the written medium.

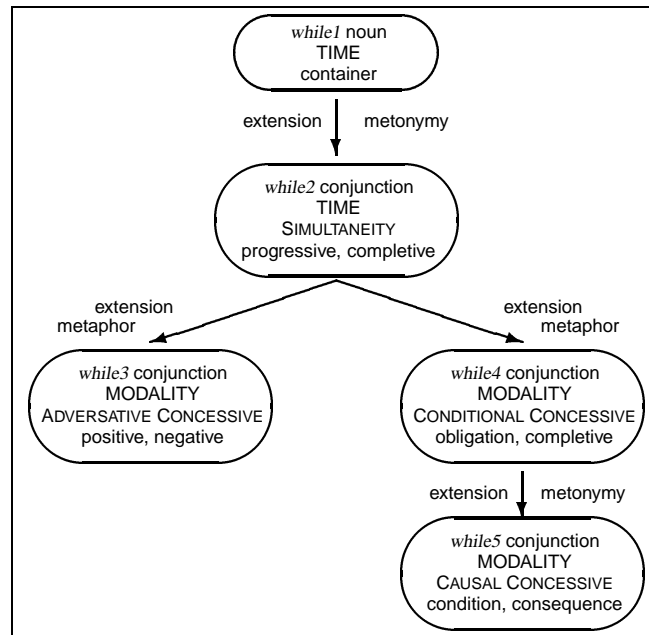


Figure 1: Grammaticalization cline of *while*

7 Summary

As we have seen the TEMPORAL meaning of *while* is presupposed in all grammaticalizations, except in the ADVERSATIVE CONCESSIVE sense. Therefore it represents the prototypical core meaning from which all other senses derive. The initial grammaticalization from the noun to the conjunction is a typical case of bleaching, i.e. reduction of semantic components whereby the semiotic function of *while* changes from an icon to an index. Yet, the emptying of meaning occurs in the same domain. Once the minor grammatical category is derived, the grammaticalization cline continues metaphorically by a shift from reference to the text world to reference to the internal cognitive situation of the speakers, i.e. from objective to subjective reasoning, from the speakers' measurement of TEMPORAL periods to their measurement of EVALUATIVE and ATTITUDINAL values (Zelinsky-Wibbelt, 2001). Thus our grammaticalization cline of *while* starts from the speakers' reference to the relatively stable nature of their external environment by lexical concepts. The cline initially increases the textual relevance and then continues to increase the relevance which the text has for the speakers, as represented in figure 1.

8 Conclusion

We have shown that the isomorphism of image schemata bears implications with respect to lexicography and translation. By virtue of their cultural independence image schemata may be evaluated multilingually. By accounting for translational equivalents, this contrastive perspective may enable the verification of universal categories of human experience. We may empirically represent the lexical domain by proceeding from the theoretical hypothesis that the image-schematic core meanings involved in the speakers' grammatical meta-knowledge structure the whole lexicon. This may be further evaluated from a typological perspective. Polysemous predications, such as *while* which may express both the lexically autonomous concept and the grammatically dependent relational concept, are a case in point.

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