Chapter 1

Typology of Complement Clauses

Magdalena Lohninger
University of Vienna

Susi Wurmbrand
University of Vienna

Put abstract here with \abstract.

1 Introduction—Universal questions about complement clauses

Following Dixon (2010), complement clauses can be defined along several dimensions: they have the internal structure of a clause (i.e., a predicate-argument configuration); they function as a core argument of another predicate (the matrix or main predicate); they are restricted to a limited set of matrix predicates; and they describe semantic concepts such as propositions, facts, activities, states, events or situations (they cannot simply refer to a place or time). In this chapter we will follow this characterization and summarize major findings of clauses that "fill an argument slot in the structure of another clause" (Dixon (2010), 370).

When looking at complement clauses typologically, one striking characteristic is found: despite extensive variation, there are restrictions of different sorts within and across languages, determined by the semantics of the matrix predicate, the semantics of the complement clause as well as the complement's morphosyntactic properties. No language follows an "anything goes" strategy and the combination of matrix predicates and different types and meanings of complement clauses is often not free. However, these restrictions are not completely uniform. Cross-linguistically, the meaning of a complementation configuration is

mapped to different morphosyntactic types of complement clauses and the question arises whether the combinatorial possibilities are systematic. Is the complement clause dependent on the matrix predicate's semantics? Does the semantics of the embedded clause restrict the meaning of the main verb? Does each matrix predicate have a unique morphosyntactic type of complement clause at its disposal? Depending on the theoretical focus of an approach, different properties are foregrounded, and these questions may receive (partly) different answers. However, a conclusion that has emerged—in one form or another—from the typological works on complementation is that the three factors (semantics of the matrix predicate, semantics of the complement, and morphosyntax of the complement clause) stand in some sort of reciprocal and interactive relationship. An important question, the answer to which the different accounts may disagree on, is how to define this relationship, how to implement the typological generalizations or tendencies, and how to build a systematic account of complementation.

In this chapter, we summarize a selection of functional-typological and structural-grammatical approaches to complementation, highlight their main focus and goals, and present the generalizations and classifications emerging from these works. Depending on the scope, focus and terminology of an approach, different classification systems arise, which sometimes appear to even contradict each other at first sight. However, despite these differences, we show that putting aside fine-grained distinctions, a unifying observation is that the combination of different types of complement clauses and different types of matrix verbs is restricted and to some extent predictable. These restrictions are either based on the meaning of the matrix predicate and/or the complement clause or on the morphosyntactic coding of the complement clause. Importantly, all approaches take semantics and syntax into account and propose frameworks to characterize the mapping between the two. As we will see, accounts vary in the number of complement clause classes, number of matrix verb classes and number of combinatorial possibilities they allow. However, a common property found in all approaches, in one form or another, is that complementation configurations are ranked along some kind of hierarchy. In this article, we will conclude that hierarchical organization is the only universal property of complement clause configurations. More specifically, there are no absolute universals in the area of complementation, but there are nevertheless implicational properties (relative universals) which can be defined and tested across languages.

In the first part of the chapter, we lay out the main observations and conclusions of the following four functional-typological accounts:

Givón (1980) builds a classification based on the concept of influence of the matrix agent over the embedded agent. If the influence is high, the complement tends to be mapped to a dependent, morphosyntactically deficient syntactic configuration (e.g., the complement is restricted in terms of its subject, it has reduced tense-aspect-modality [T/A/M]-marking, and the matrix and embedded predicates may unify in various ways). The semantic interaction between the two agents thus renders a more or less dependent complement clause. Based on that, six semantic groups are isolated which stand in a hierarchical relationship to each other and are aligned with different morphosyntactic types of complement clauses.

Noonan (2007) focuses mostly on the similarity of complement clauses to main clauses and the independence of their time reference. Complement clauses are divided into six syntactic classes, based on the independence of the embedded subject, the embedded T/A/M-possibilities, and the distinction whether the complement behaves like a main clause (s-like) or not. The classes are ranked from being very s-like to being very reduced, and differ regarding properties such as whether the embedded clause has predetermined time-reference or not. Matrix predicates are classified into 13 classes, differing by their meaning and whether their complement clause is s-like and has independent time-reference or not.

Cristofaro (2005) focuses on the semantics of the matrix predicate and suggests that semantic and syntactic form of the complement clause are solely determined by the main verb. The crucial semantic properties of complement clauses are their predetermination of time, aspect, mood and participants, as well as their semantic integration into the matrix clause. Semantic integration is the degree to which the boundaries between the two clauses are eroded and defined by the semantics of the matrix predicate. Based on predetermination and integration, summed up as "Deranking" of the embedded clause, a *Hierarchy of complement clause deranking* is formulated. Matrix predicates are ordered on this scale, depending on how predetermined and integrated their complement clause has to be.

Dixon (2010) focuses on the semantics of the complement clause. He divides complement clauses into three types. The differing criteria are what the embedded clause semantically refers to, its T/A/M-marking, and the independence of the embedded subject and the embedded time-reference. Additionally, he parts matrix predicates into eight classes, depending on their meaning. The three complement clause types combine with the eight predicate classes depending on the semantics. This yields a wide range of complement clause configurations, not sorted hierarchically or on any other scale.

The second part of the chapter summarizes structural-grammatical accounts of clause structure and complementation which emphasize the universal syntax–semantics interface of complementation. All three approaches discussed here come to the conclusion that there is a hierarchy of clause structure which is observable in complementation as an interaction between the (semantics of the) matrix predicate and the size or complexity of the complement clause. The details and richness of the hierarchies, however, vary in the different approaches.

Cartographic approaches, like Cinque (1999; 2004), bring forward a semantic hierarchy of clausal categories. The hierarchy is mapped to an equally fine-grained syntactic structure, where each semantic category corresponds to a functional projection in the clausal spine, covering the distribution of adverbs, affixes, auxiliaries, and certain verbs. Cartographic approaches focus on the ordering of syntactic structure and propose that each semantic category has a designated universal position in the expanded clausal spine. Syntax is thus dependent on semantics and, in principle, no mismatches between the two are allowed. The fine-grained clausal hierarchy derives monoclausal complementation and may be extended to complementation in general.

Ramchand & Svenonius (2014) do not directly examine complement clause constructions but present a framework of clause structure which can be directly applied to complementation. They focus on the delineation and semantic definition of clausal domains and suggest containment configurations in which clausal domains of different sizes are elaborations of smaller domains. This system derives the cross-linguistically stable implicational hierarchies among clausal domains. Meaning and form are tightly interconnected in this account, mutually influencing each other, however the approach also leaves room for certain syntax–semantic mismatches.

Wurmbrand & Lohninger (2019) focus on the semantics of the complement clause and its syntactic structure as well as the semantics of the matrix predicate. The three components are connected; however, typologically, the connection is not unique but leaves room for variation. Although there are cross-linguistic tendencies, there is no specific syntactic structure corresponding to a particular complementation configuration but only requirements about the minimal structure necessary to interpret a complement in a particular way. They part complement clauses and their matrix predicates into three broad classes which form an implicational hierarchy. This hierarchy describes how syntactically dependent, transparent and integrated a complement clause is, but does not prescribe a specific syntactic type of complement. Matrix predicates and complement clauses are in a synthesis relation, which allows mutual influence between the two.

The last section provides concluding remarks about the observed differences, variation, and universality found in the area of complementation.

2 Functional-typological approaches

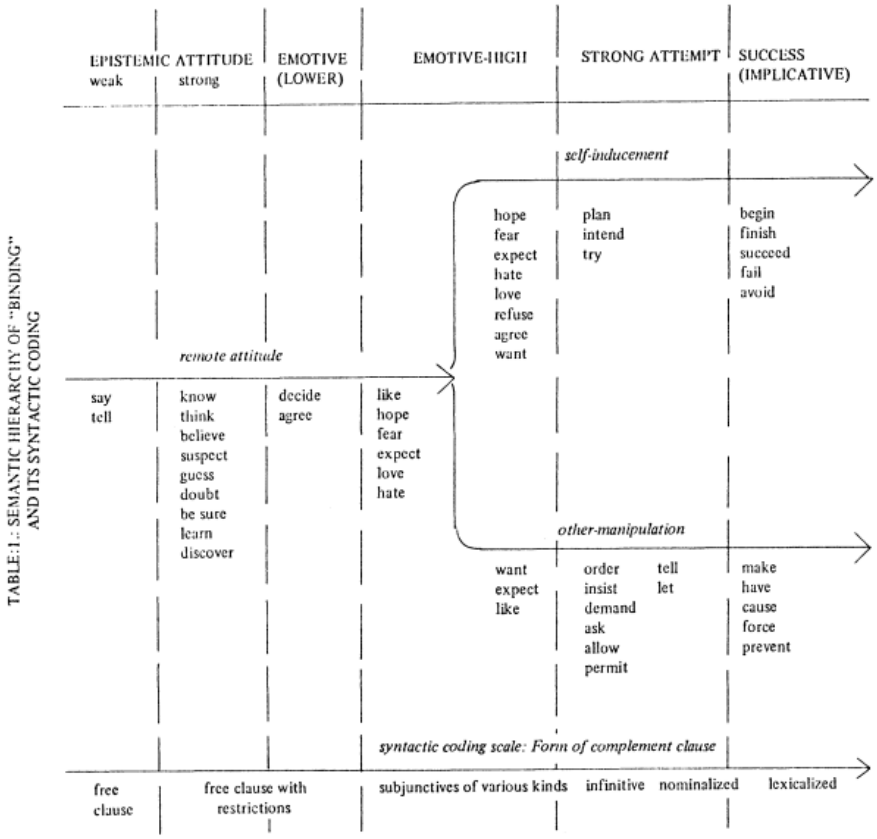
Functional-typological and structural-grammatical accounts differ in the nature of the linguistic primitives and explanations, as well as the angle from which they look at language data. Functional approaches are foremost empirically oriented, focusing on large-scale data surveys from which typological similarities are extracted and classifications and a system are derived. Generative accounts are often built on generalizations and in-depth investigation of a smaller sample of languages, involving a higher degree of theoretical abstraction and leading to hypotheses which can be tested in a larger set of data. Functional-typological and structural-grammatical approaches also differ in the kind of tools and primitives they employ to characterize language phenomena. To illustrate, consider the relation between an embedded subject and a matrix argument. In Givón (1980)'s functional approach, for instance, the relation is a function called "binding" which is described as the influence of the matrix agent over the embedded agent. Criteria like "exerting influence" are extragrammatical in that they describe what is observable outside the language configurations. In structural-grammatical accounts, the concept of subject-dependence is called "control" or "coreference" which describe abstract formal dependencies relating two arguments via sentence-internal configurational concepts such as c-command.

The four functional-typological accounts summarized here differ in focus, scope and various terminological choices. A common goal of these works is to characterize the regularities observed in the mapping between semantics and morphosyntax. Other similarities involve the relevance of different degrees of (in)-dependence as a characteristic of different types of complement clauses, and the observation that different types of complement clauses stand in a hierarchical relation to each other. Although the emerging classifications overlap, they also differ in various ways, and it remains to be seen whether a full unification of these approaches is possible.

2.1 Givón 1980

Givón (1980) proposes a typological-functional approach to complement clauses. The main observation is that that there is a universal semantic/syntactic hier-

archy regulating the distribution of matrix predicates and corresponding complement clauses. Complement clause taking predicates and their corresponding complement clauses are ordered on a hierarchical scale called the *Binding Hierarchy*. On this scale matrix predicates are grouped into semantic types and ordered by their semantics. This hierarchy is aligned with syntactic properties of the complement clauses. The syntactic forms are defined by a *Syntactic Coding Scale*, describing the (in)dependence of a complement clause and by that its "clausehood". The exact configuration can be seen in the figure below. The top branching arrow is the *Binding Scale*, ranking matrix predicates based on their semantics. On the bottom is the *Syntactic Coding Scale*, defining the morphosyntactic form of the complement clauses. The two scales are aligned. The highest point of the scale is to the right which involves complements with the highest integration into the matrix predicate. The lowest point is to the left which involves complements most resembling an independent clause. The lower a complement clause is on the *Binding Hierarchy*, the more syntactically complex it becomes. Complexity is defined by similarity to a main clause. How high or low a complement clause is on the scale is defined by the height of its matrix verb on the *Binding Scale*.



(The *Binding Hierarchy*, Givón 1980, 369)

The *Binding Scale* is a semantic dimension and describes the degree of integration of a complement clause into the matrix clause. The complement clauses are ordered along a *Syntactic Coding Scale*. Combining the two scales yields the *Binding Hierarchy* which connects the semantic properties of the matrix predicate with the morphosyntactic properties of the complement clause. Both scales express different degrees of integration—semantic or morphosyntactic—of the complement clause into the matrix clause. The *Binding Hierarchy* is thus defined both semantically and syntactically and is derived by the combination of matrix verb and complement clause.

The semantic dimension of the *Binding Hierarchy* (the *Binding Scale*) is derived by ordering matrix predicates along a functional semantic scale, based on the emotional commitment of their matrix agent. The higher the influence of

the matrix agent exerted over the embedded agent, the higher the verb is on the binding scale. On the one hand, the more the agent of a cognition-utterance verb is emotionally committed to the outcome of the complement clause, the higher the verb will be on the binding scale. On the other hand, the more emotionally involved the agent of a manipulative matrix verb is, the lower the verb will be on the scale. This is due to the fact that the more successful a matrix agent is in manipulating the embedded agent to do something, the less emotion he or she has to exert. The binding scale ranges from very strong binding verbs on the right of the scale to very weak binding ones on the left. Matrix verbs are sorted into semantic types, being (from right to left): Success (implicative) verbs *(begin, finish, make, force,..)*, strong attempt verbs *(plan, intend, order, insist,…)*, high emotive verbs *(like, hope, fear,…)*, low emotive verbs *(decide, agree,…)*, attitude verbs *(know, think, believe,…)* and epistemic verbs *(say, tell)*. Success (implicative) predicates are the highest point of the scale whereas epistemic predicates define the lowest point. The semantic form of the complement clause is defined by its degree of integration into the matrix clause. This means, the higher the verb on the binding scale, the more integrated its complement clause is. "Integration" is defined by three properties (Givón 1980, 335):

- **Binding**: The stronger the influence of the matrix agent is over the embedded agent, the higher is the matrix verb on the binding scale.
- **Independence**: The higher a verb is on the binding scale, the more dependently acts the agent of its complement clause.
- **Success**: The less independent the embedded agent is and the higher the matrix predicate is on the binding scale, the more is the intended output likely to succeed.

These three properties show that not only does the matrix predicate influence the semantics of the embedded clause, the complement may also affect the matrix predicate. The more independent an embedded clause is, the lower its matrix verb is placed on the binding scale. Thus, there is a bidirectional influence and only the combination of matrix verb and complement yields a successful output. Verbs can also have double membership, meaning they can occur with different types of complement clauses, which may change the meaning. Verbs can thus be located on two points of the scale and have multiple positions on the binding scale. The semantic (in)dependence of the complement clause is reflected in its syntactic properties. The higher the matrix verb on the binding scale, the more dependent its complement clause is. The more dependent it is, the more it is syntactically

coded as dependent.

The syntactic dimension of the *Binding Hierarchy* is notated as the *Syntactic Coding Scale*. The morphosyntactic structure of complement clauses is predictable from the position of their matrix verb on the binding scale. "The higher a verb is on the binding scale, the less would its complement tend to be syntactically coded as an independent/main clause." (Givón 1980, 337). Being coded as an independent clause means that certain properties of the complement clause resemble a main clause. These properties are: The degree to which the complement clause agent resembles a main clause agent. This means, how much it reflects the agent-marking of a main clause. Next, the degree to which the T/A/M-system of the complement clause is preserved. Finally, the presence of predicate raising of the complement verb onto the main verb. Predicate raising describes a process in which the embedded verb is lexicalized as one word with the matrix verb. A complement clause is the most independent if its agent-marking and T/A/M-marking allow the same configurations they do in the main clause and if there is no predicate raising. It is the least independent if it does not allow an independent agent, has no or only minimal T/A/M marking and if its predicate is predicate raised. Since the *Binding Hierarchy* is scalar and not binary, these two options only describe the ends of the scale with various possibilities in between. As can be seen on the *Syntactic Coding Scale*, the most independent clause is a free clause, then comes a free clause with restrictions of different kinds, then come subjunctives of various kinds, then infinitives, nominalizations and the least independent ones are lexicalized. These syntactic configurations are aligned with their matrix predicates; Higher verbs (meaning further to the right) take very dependent clauses whereas lower verbs on the binding scale take independent complement clauses.

Putting syntax and semantics together, which means aligning the *Syntactic Coding Scale* with the semantic *Binding Scale*, the *Binding Hierarchy* emerges. it shows how the semantic hierarchy of binding matches the syntactic hierarchy of clausehood. The *Binding Hierarchy* is a hierarchy in the way that if a point on the semantic scale (a predicate) is obligatorily coded by a certain syntactic device (e.g. subjunctive or infinitive), then a semantically higher predicate cannot be coded by a syntactically lower device. This means, there is a correspondence between the semantics of the matrix predicate and the syntax of the complement clause. They stand in an implicational relationship to their surrounding elements on the scale. Additionally, the points on the scale are not discrete but overlap, forming a gradual increase of binding from right to left. Importantly, semantics and syntax influence each other and only their combination yields a hierarchical structure. According to to Givón (1980), the *Binding Hierarchy* is universal and can be found,

with different reductions, in all languages.

2.2 Noonan 2007

The functional complementation classification proposed in Noonan (2007) combines complement clause size and meaning, the semantics of the matrix predicates and the combinatorial possibilities. According to this approach, languages vary in what type and number of complement clauses they have at their disposal. English, for example, has four options for clausal complementation: *that*-clauses, infinitive clauses, gerundial or verbal noun clauses, and participial clauses. Other languages, like Irish, only have two options of complementation (Noonan 2007, 54):

(1) a. Dúirt sé *go dtiocfadh sé.*
said.3.SG he COMP come.COND he
'He said that he would come.' (*Go*-clause)

b. Is maith liom *iad a fheiceáil.*
COP good with.me them COMP see.NMLZ
'I like to see them.' (Verbal noun)

Languages may have up to five types of complement clauses. These types differ from each other by the morphosyntax of the complement clause, the syntactic relation between the complement predicate and its arguments, and the semantic relation of the matrix predicate with the complement clause.

The morphosyntax of the complement clause can either be sentence-like (s-like) or reduced/non-sentence-like (non-s-like). S-like complement clauses have roughly the same syntactic form and size as main clauses. The complement predicate of s-like clauses has the same relation to its arguments as a main predicate would have in the given language. S-like complement clauses involve either *indicative* or *subjunctive* predicates, subjunctive differing from indicative usually in that the inflectional categories are slightly reduced. *Subjunctive* is at the border between s-like and non-s-like and usually comes, similar to indicatives, with a complementizer. Only languages with tense and aspect morphology tend to make an indicative–subjunctive distinction, others tend to not exhibit a subjunctive form. Another s-like complementation strategy is parataxis or verb serialization. These constructions typically consist of a subject NP which is followed by a series of fully inflected verb phrases. There is no marker of coordination or subordination (such as a complementizer) between them and the predicates do

not come in a special form other than indicative. Therefore, they are classified as s-like complement clauses.

Non-s-like complement clauses, in contrast to s-like ones, do not behave like main clauses. This difference usually lies in the morphology of the complement predicate—e.g., infinitive instead of indicative or subjunctive. The main difference between indicative/subjunctive predicates and infinitives is that the latter lack a subject and typically cannot stand on their own. However, although infinitives are not s-like, they still establish the same predicate–object relation as main-clause predicates and are thus still verb-like. Other non-s-like complementation strategies are nominalizations or participials, which are noun-like instead of verb-like. In noun-like configurations, the embedded subject is often marked as a possessor and when nominalized, predicates typically realize case and number like "regular" nouns. When the embedded predicate is a participial, also called converb, it appears in adjectival or adverbial forms and functions as a predicate modifying a noun. A summary of the morphological forms described above is given in the table below (Noonan 2007, 75).

Complement Type	Part of speech of predicate	Syntactic relation of subject to predicate	Range of inflectional categories	Other characteristics
indicative	verb	same as main clause	same as main clause	s-like form (nearly) identical to declarative main clause
subjunctive	verb	same as main clause	typically reduced	s-like form that differs from declarative main clause – when main clause, often used in hortative or imperative senses
paratactic	verb	predicate may agree with subject, but does not form constituent with it	same as indicative	interpreted as separate assertion; syntactically not a subordinate clause; cannot take complementizer
infinitive	verb	predicate cannot form constituent with subject	reduced; cannot take subject–verb agreement	relations with object same as indicative
nominalization	noun	genitive relation between subject and predicate	reduced; may take nominal categories such as case and number	may have internal structure of NP; frequent gradation between nominalizations and infinitives
participle	adjective or adverb	subject is head, rest of predication is modifier	reduced; may take adjectival inflections when agreeing with subject	syntactically may conform to principles governing adjectives

(Complement types in Noonan 2007, 75)

Certain **syntactic processes in complementation** can render the complement clause morphology to become less s-like. Such operations include (what Noonan 2007 calls) equi-deletion, argument raising, incorporation of reduced complements into the matrix clause and restrictions on the sequence of tense/mood.

Noonan (2007) suggests that if one of these operations applies, the resulting complement clause becomes less s-like, thus the operation itself influences the form of the complement clause.

Equi-deletion (in generative approaches also called 'control') refers to configurations in which the subject of a complement clause is deleted under identity with a participant of the matrix clause. Consider the following example (Noonan 2007, 75):

(2) Zeke wants *to plant the corn.*

In (2), *Zeke* is understood as the subject of both, the matrix and the complement clause. To avoid redundancy, it is deleted from the complement clause. This operation usually influences the complement clause and renders it less s-like or, put differently, is only possible with non-s-like complements.

In argument raising, the embedded subject is moved from the complement clause to the main clause, which again results in non-s-like complement clause morphology. Argument raising is also known as *subject raising, raising to object* or *exceptional case marking* in generative accounts and illustrated in (3) (Noonan 2007, 79). The embedded subject *Harriet* has been raised to the matrix clause (or at least enters a case dependency with the matrix predicate), leaving behind a non-s-like (infinitive) complement clause.

(3) Irv believes *Harriet* to be a secret agent.

Another syntactic operation in complement clauses is incorporation of into the matrix clause. A reduced complement clause has fewer syntactic and inflectional possibilities than a main indicative clause. If reduced enough, it can be integrated into the main clause by *Clause Union* (see Aissen & Perlmutter 1976; 1983; Strozer 1976; 1981). In Clause Union configurations, the matrix and complement predicates share the same set of grammatical relations, as for instance in causative constructions (Noonan 2007, 84):

(4) Roger laissera manger les pommes à Marie.
Roger let.3SG-FUT eat.INF the apples to Marie
'Roger will let Mary eat the apples.'

In cases such as the French example in (4), the predicates *let* and *eat* are combined and form one complex, ditransitive predicate which takes *Roger*, *the apples* and *Marie* as its three arguments. Thus, the complement clause borders are eroded and only a single main clause remains.

A further syntactic (and partly also semantic) phenomenon involves restrictions on what tense marking and time-reference a complement clause can display. Tense can either be restricted or non-restricted. Noonan (2007) refers to complement clauses with unrestricted tense as "independent time reference" (ITR). ITR is the ability of referring to an independent point in time and displaying different tense values. In contrast to ITR, "dependent/determined time reference" (DTR) contexts show a restriction on the temporal options in the complement clause—the matrix predicate influences the time of the embedded proposition. In DTR contexts, tense can be copied from the matrix predicate or be determined by the matrix predicate (e.g. require a particular tense value, such as future morphology). Whether time-reference is determined depends on the semantics of the matrix verb: Certain predicates require DTR whereas others do not.

Not only time-reference but all of the above listed syntactic operations are enabled by certain semantic values of the matrix predicate. Noonan (2007) classifies matrix verbs into different types, laid out below. The main claim is that "the stronger the semantic bond between the events described by the matrix and complement predicates, the greater the degree of syntactic integration there will be between the two clauses." (Noonan 2007: 101). The concept of syntactic integration is related to the degree of reduction of a complement clause. The more syntactically integrated a complement, the more reduced it is and the more it tends to allow syntactic operations linking the matrix and embedded clauses (such as equi-deletion, predicate-raising, etc.). S-like complements have the lowest degree of syntactic integration, non-s-like complement clauses the highest. However, integration of the complement clause is not regulated by the morpho-syntax alone but also by semantic properties.

The semantics of complementation is a combination of the semantics of the matrix predicate and the semantic properties of the complement clause. The semantic potential of a complement clause is a compound of its mood distinctions, its degree of reduction and the type of matrix predicate. Complement clauses can either be subordinated or paratactic. If subordinated, they form one assertion together with the matrix clause, which is usually the case in causative and immediate perception environments. In paratactic complementation, two assertions arise—one for the matrix clause and one for the embedded clause. The semantics of assertion is reflected in syntax: Subordinated clauses behave syntactically differently from paratactic ones.

The two basic mood distinctions of complement clauses are indicative and subjunctive. Indicative complement clauses resemble a main clause in the independence of their time-reference (free), truth-value (realis) and discourse depen-

dency. Subjunctive complement clauses have determined time-reference (DTR, usually a future relative to the matrix time) and are typically irrealis. However, subjunctive and irrealis do not always go together. Some languages, like Russian, mark the realis–irrealis distinction with mood (indicative and subjunctive), other languages code it differently.

If a complement clause has neither indicative nor subjunctive form, it is reduced. The degree of reduction is based on the semantic principle that information is neither repeated nor lost. One syntactic manifestation of reduction are infinitives versus finite indicative clauses. The reduced infinitive can only be used when it does not result in a loss of information. Whether an infinitive is licensed depends on the matrix predicate—some contain enough information (*believe, remember, promise,…*) to allow a reduced complement whereas others (*regret, know, imagine,…*) do not and require an indicative or subjunctive complement.

In addition to the semantics of the complement clause, the semantics of the matrix predicate has a strong influence on the shape of a complementation configuration. Noonan (2007) divides matrix predicates into 13 semantic groups which differ, on the one hand, in what they mean, and, on the other hand, in what time-reference and proposition their complement clause may have and how syntactically reduced it will be. Thus, the semantics of the matrix predicate influences the morphosyntactic form of the complement clause and vice-versa. Noonan's semantic classes and descriptions are summarized below:

- **Utterance predicates** (*say, tell, report,…*) take s-like (indicative) complement clauses with ITR and describe a simple transfer of information.

- **Propositional attitude predicates** (*believe, think, assume, deny,…*) take s-like (indicative or subjunctive) complement clauses with ITR and express an attitude towards the complement proposition.

- **Pretence predicates** (*imagine, pretend, trick into,…*) take s-like (indicative) complement clauses with ITR. The world described in the complement proposition does not correspond to the real world.

- **Commentative predicates (= factives)** (*regret, be sorry, be sad*) take s-like (indicative or subjunctive) complement clauses with ITR. The complement clause comments on the matrix proposition and the complement proposition is discourse-dependent in that it takes the matrix proposition as a topic.

- **Predicates of knowledge and acquisition of knowledge (= semifactives)** (*know, discover, realize, forget, indirect perception verbs*) take s-like (indicative) complement clauses with ITR. The complement proposition is presupposed to be true.

- **Predicates of fearing** (*be afraid, worry, be anxious,…)* take s-like (indicative or subjunctive) complement clauses as well as non-s-like ones (infinitive). Depending on the form, the complement exhibits ITR or DTR. Predicates of fearing express an attitude towards the complement proposition.

- **Desiderative predicates** (*wish, want, desire, hope,…*) mark a desire that the complement proposition is realized and are further divided into three subgroups: the *hope*-class which takes s-like (indicative) complement clauses with ITR and expresses an emotional attitude; the *wish*-class which also takes s-like complement clauses with ITR but yields a contrafactive interpretation; and finally, the *want*-class which takes non-s-like (subjunctive or infinitive) complement clauses with DTR, namely future reference.

- **Manipulative predicates** (*cause, force, make, tell, order, command,…*) take non-s-like (subjunctive or infinitive) complement clauses with DTR. Manipulative predicates express the matrix agent's attempt to manipulate the affectee to do something.

-**Modal predicates** (epistemic and deontic *can, ought, should,…*) take non-s-like (subjunctive or infinitive) complement clauses with DTR (usually a future interpretation) and typically render clause union.

- **Achievement predicates (= implicatives)** (*manage, dare, remember, try, forget,…*) take non-s-like (infinitive or nominalized) complement clauses with DTR, expressing the same time reference as the matrix predicate. They either refer to the realization or the lack of achievement in the complement proposition.

- **Phasal predicates** (*begin, start, continue, stop, finish,…*) take non-s-like (converb, nominalized or infinitive) complement clauses with DTR, expressing the same time reference as the matrix predicate. They describe the 'phase' (for example the beginning) of an act.

- **Immediate perception predicates** (*see, hear, watch, imagine,…*) take non-s-like (converb or infinitive) complement clauses with DTR, expressing the same time reference as the matrix predicate. The matrix subject directly perceives the event of the complement clause.

- **Conjunctive predicates**: A few languages (for example Lango) use verbs to translate the English "and (then)". Complement clauses to these predicates can be s-like or non-s-like and have ITR or DTR.

Although, as shown above, the classification of predicates in Noonan (2007) is very detailed, the 13 classes can be subsumed into three coarser types, based on whether predicates take s-like or reduced (non-s-like) complements and whether the complement clause involves ITR or DTR. The resulting classes are given in

Table (1).

Table 1: Complement clause types in Noonan (2007)

Complement type	**Time reference**	**Matrix predicate**
S-like (indicative/subjunctive)	ITR	utterance, propositional attitude, pretence, commentative
Reduced (infinitive, converb, nominalization)	DTR	manipulative, modal, achievement, phasal, immediate perception
Both s-like and reduced	ITR/ DTR	knowledge, fearing, desiderative

All languages have the same general set of matrix predicate options combining with the same set of propositions. Additionally, the matrix predicates also behave uniformly in whether they take s-like or reduced complement clauses. However, the number of different sub-distinctions varies across languages. According to Noonan (2007), all languages have at least one s-like and one reduced (in whatever form) complement clause type. When a language only distinguishes between two types of complements (the minimal inventory), the difference is usually manifested in time-reference: one type of complement will have ITR, whereas the one type (the reduced one) will have DTR. Languages with three types of complement clauses typically exhibit an s-like indicative form with ITR, an s-like subjunctive form with DTR or ITR, and a reduced form with DTR. Languages with four types of complement clauses usually involve an s-like indicative (ITR), an s-like subjunctive (ITR or DTR) and two reduced types of complements with DTR. Languages with more than four types of complement clauses are rather uncommon.

Noonan's typological observations point towards an implicational universal which is noted in different forms in other works on complementation. Complements fall into different classes which form a scale of (in)dependence. On the ends of the scale are, in Noonan's terminology, s-like and fully reduced complements, and languages need to have at least two types of complement clauses to distinguish (in)dependence. One of the main distinguishing properties of s-like vs. reduced complement clauses is determined or independent time-reference. However, (in)dependence is not a binary property, but in-between the two ex-

tremes, there is space for other forms, with different degrees of semantic and syntactic integration and dependence. Lastly, an important conclusion is that the semantics of the matrix predicate influences the morphosyntactic form of the complement clause and vice versa.

2.3 Cristofaro 2005

Cristofaro (2005) proposes a functional classification tool for complement clauses which is based on the claim that the semantics of the main predicate determines how the embedded predicate is shaped, semantically and syntactically. The classification of matrix predicates is adopted from Noonan (2007), namely modal predicates, phasal predicates, desiderative predicates, manipulative predicates, perception predicates, knowledge predicates and utterance predicates. By focusing on semantic features of complement relations, an approach of hierarchically built complement clause types is developed. This approach rests on a level-based clause structure, predetermination of embedded semantic features and semantic integration.

As for the first concept, **the levels of clause structure**, a clause consists of four layers which are built on each other and thus entail each other. Each of these four layers has different functional properties and is evaluated by different benchmarks. The basic layer involves predicates or terms which can be placed in space and time and are evaluated in terms of their reality. The second layer involves predication which is evaluated in terms of existence. The third layer involves propositions which are evaluated in terms of their truth value. The fourth and last layer is the entire clause which incorporates the speech situation as a whole by referring to the speech act. It is evaluated in terms of felicity. Different complement relations are related to different layers of clause structure. Manipulative and perception predicates act at the predication level; knowledge, propositional attitude and utterance predicates use the proposition level; and modal, phasal and desiderative predicates pertain to the predicate/term level or to the predication level. The matrix predicate classes are thus grouped into three broad groups as summarized in Table (2).

Table 2: Functional levels pertained by matrix predicates

Knowledge, propositional attitude, utterance predicates	**Proposition-level**
Perception, manipulative predicates	**Predication-level**
Modal, phasal, desiderative predicates	**Predicate/Term-level/ Predication-level**

The semantic influence exerted by the matrix predicate over the complement clause manifests itself in two ways: Predetermination of semantic features and semantic integration. Predetermination is observable in complement clauses when certain semantic features are predetermined by the matrix verb. Time reference, T/A/M-specifications and embedded participants (agents) are the most common predetermined features.

Time-reference: Complement clauses of proposition-level predicates have no predetermined time-reference. Predication-level verbs require predetermination to some extent: With perception verbs, the embedded time must be simultaneous, with manipulative verbs, the embedded time must be posterior to the matrix time. For predicate/term verbs, the complement time-reference is predetermined. However, for modal and desiderative verbs, the embedded time is irrelevant to the complement relation.

Aspect: Proposition-level predicates allow any aspect values in their embedded complement clauses. Predication-level predicates and phasal predicates require a certain aspect value. For complement clauses to predicate/term-level predicates, the embedded aspect value is irrelevant for the complementation relations. However, it usually is determined to some extent.

Mood: Knowledge, perception, manipulative and phasal predicates require factual complement clauses whereas propositional attitude and utterance predicates demand non-factual complements. For modal and desiderative verbs the mood value is irrelevant since it is also irrelevant whether the embedded proposition even took place.

Participants: The embedded participants are undetermined with proposition-level predicates but determined with all others. This means that with proposition-level predicates, the embedded clause can have an independent subject, whereas with all other predicates, it tends to have a subject identical to a participant of the main clause.

The second criterion for semantic influence is *Semantic Integration* of the complement clause into the matrix clause. In complementation, the main and embedded clauses are interconnected to a certain degree which varies depending on the type of complement. Utterance predicates, for example, show no interconnection with their embedded clause, perception predicates show interconnection to some degree and manipulative predicates show a very high degree of interconnection. This interconnection is called semantic integration. Semantic integration is higher if the main and embedded clauses share their referents and spatio-temporal configuration. However, semantic integration is not dependent on spatio-temporal configurations. It only describes that the more integrated a complement clause is into a main clause, the more the two events are part of a single event-frame. Hence, semantic integration characterizes how (in)dependent the embedded event is from the main event. The more dependent the embedded event, the more the main and embedded clause are part of a single event-frame. If they form a single event, they tend to overlap spatio-temporally. Therefore, predetermined referents and time/place is a reflex of semantic integration and not the other way around. The most basic component of semantic integration is the degree to which the boundary between the main and complement clause is eroded. Take for example a phasal predicate like *start*: in a complementation configuration, there are two events but their boundaries are eroded since starting an action is part of the action itself. Utterance predicates behave differently: a matrix predicate like *say* is not connected to the action in its complement clause and therefore, there are two entirely separate events—the saying event and the embedded event. Modal predicates are in between. The two events are distinct and have low semantic integration, however, they share the same participant, time and T/A/M features and thus, semantic integration is given to a certain degree. Cristofaro (2005) claims that semantic integration is not a binary feature but a scale—it forms the semantic integration hierarchy in (5). Since knowledge, propositional attitude and utterance predicates show no semantic integration at all, they are not part of the hierarchy. Modal and phasal predicates form the highest point on the hierarchy, followed by manipulatives, and desideratives and perception predicates are on the lowest point of the hierarchy.

(5) **Semantic Integration Hierarchy**:
Phasals > Modals > Manipulatives > Perception/Desideratives

Combining predetermination and semantic integration, Cristofaro (2005) develops a typological hierarchy of complement clause deranking, as shown in (6) (adapted from Cristofaro 2005, 122). "Deranking" describes on the one hand the degree to which the complement clause has predetermined time-reference, T/A/M

and participant values. and on the other hand the erosion of boundaries between the matrix and embedded clause, i.e. semantic integration. The elements to the left show the most predetermination and highest semantic integration, whereas the elements on the right exhibit the opposite features. Importantly, the hierarchy describes the combination of the matrix predicate's semantics and the form of the complement clause.

(6) **Hierarchy of Complement Clause Deranking**:
Modals/ Phasals > Manipulatives/ Desideratives/ Perception > Knowledge/ Propositional Attitude/ Utterance

The *Hierarchy of Complement Clause Deranking* is hierarchical in the sense that if deranking of the complement clause is used at any point of the hierarchy, then it is used at all points to its left as well. It holds for all factors of deranking: T/A/M-marking, person agreement and sharing of participants. Importantly, the hierarchy is a scalar and not binary. The cross-linguistic distribution of complement clauses does not involve two parametrical options, but rather a scale which codes decreasing semantic integration and increasing independence of the complement clause. It is based on the matrix predicate selecting the complement clause but only the combination of the two yields a hierarchical form.

2.4 Dixon 2010

Dixon (2010) provides a classification of complementation which takes into account the grammatical properties (i.e. the syntax) of complement clauses as well as their semantics. Examining the cross-linguistic variation, patterns of mutual influence between the semantics of the matrix predicate and the form the complement clause are observed, which lead to a universal tripartition of complement clause types.

In addition to the question of where different types of complement clauses are situated in the general picture of complementation, there are certain grammatical peculiarities in the internal structure of complement clauses. The grammatical profile and inventory of formal marking varies cross-linguistically. Languages have between two and five types of complement clauses, which differ in their syntactic behaviour and size. According to Dixon (2010), the main distinctions lie in the grammatical behaviour: The marking of the core arguments may be identical to that in a main clause or a complement clause may include special markers on the embedded subject. Very often, this is a possessive marker as in Jarawara, where 1st and 2nd person singular subjects are expressed as possessors in complement clauses. Another property is that complement clauses may or may

not include peripheral constituents like time or place references. This option does not only vary among different types of complementation within one language, it also shows cross-linguistic variation. For instance, there are languages which do not allow peripheral specifications at all in their complement clauses. Similarly, there is variation regarding the Tense-Aspect-Modality (T/A/M) specifications on the embedded predicate. Some complement clause types allow equally rich T/A/M specifications as main clauses, whilst others only permit a reduced set. "In English, for instance, a *that* clause has the full set of TAM choices, while *ing* and *to* complement clauses only allow auxiliaries *have (-en)* and *be (-ing)*, not permitting tense inflection or modal verbs." (Dixon (2010), 383). Another important distinction between different types of complement clauses is the possibility of an independent subject, i.e., a subject different from the matrix clause subject. Complement clauses differ regarding whether they require a subject identical to an argument of the matrix clause or allow an independent one. Finally, complement clauses differ in whether they enable constituent movement into the main clause. Constituent movement refers to an operation where an embedded subject is moved to the matrix clause and thus becomes a core argument of both predicates. Depending on the language and complement clause type, this operation is allowed or prohibited.

The syntactic properties listed above (special markers on the subject, inclusion of peripheral constituents, T/A/M specifications, possibility of an independent subject, and raising) align with certain semantic properties of the complement clause. Combining their syntax and semantics, three types of complement clauses emerge, which we will lay out after summarizing the semantic properties of complement clauses.

There are three semantic types of complement clauses, labeled "Fact"-type, "Activity"-type and "Potential"-type. They differ in their inherent semantics but also in their morphosyntactic properties.

- **Fact-type** complement clauses refer to the fact that some action took place. They have a similar structure to a main clause and allow full possibilities for negation and T/A/M marking. The embedded subject may or may not be identical to the matrix subject. The time reference of a Fact-type complement clause is independent which means that it can refer to a different time than the matrix predicate. Additionally, different tense and aspect values from the matrix clause are allowed. Typically, but not necessarily, these complement clauses are marked with a complementizer. However, complementizers may also occur with other clause types and thus are no reliable indication for Fact-type clauses. Fact-type

complement clauses may have subtypes: Such which indicate a certain fact and such which indicate a possible fact. Interrogative complement clauses are also considered as a subtype of this class.

- **Activity-type** complement clauses refer to an ongoing activity. Their predicates have structural similarities to a noun phrase but remain clausal. This means, the verb is not fully nominalized but only receives a reduced, noun-like form. However, it keeps its verbal properties and thus the complement remains a clause. In English, this is the *-ing* marking. The embedded subject may be the same as in the matrix clause or different, additionally it can be marked with a possessive marker. Activity-type complements allow less specification of negation and T/A/M-marking than main clauses and may have different time-reference than the main clause. However, tense can only be shown by a lexical marker (like an adverb) due to the reduced form of the verb. Subtypes of this class are participial clauses.

- **Potential-type** complement clauses refer to the potentiality of the embedded subject becoming involved into an activity. They have less structural similarity to a main clause than Fact-type clauses and less similarity to a noun phrase than Activity-type clauses. They lack the T/A/M choices available in main clauses and their verb has a special form, usually the infinitive. Some languages require Potential-type clauses to have the same subject as the main clause, however this is not universal. These complement clauses must either have the same time reference as the main clause or refer to a later time, i.e. have a future time reference.

Languages vary regarding which of these three types they allow. Dixon (2010) suggests that the potential to express all three meanings (Fact, Activity, Potential) is universal but that languages do not always use three distinct complement clauses to express them. Jarawara for example only has an Activity-type (which absorbs the function of the other two types and can express three meanings). Akkadian has one Fact-type construction and one for both Activity and Potential. Tariana has a Fact-type and a P-tential-type, the Activity-type is shown with pure nominalizations. Since each type of complement clauses has subtypes, languages can also have more than three complement clause constructions: White Hmong has two Fact-type complement clauses, one Activity-type and two Potential-type ones. Fijian on the other hand has three Fact-types, one Potential-type and one Activity-type.

The type and meaning of a complementation configuration is dependent on the semantics of the complement clause as well as the semantics of the matrix predicate. Each complement clause has a meaning (as detailed above) and each matrix

predicate has a meaning. However, not every matrix verb can be combined with any complement clause. Matrix predicates divide into certain classes and what complement clause type is chosen in a certain environment is dependent on the semantics of the matrix predicate. Some predicates require a unique type of complement, others may occur with different types of complement clauses resulting in different meanings. This combination-based meaning-shift can be observed in almost every language. Similar to Noonan (2007), Dixon (2010) divides matrix predicates into different types.

- **Attention verbs** *(see, hear, notice,...)* combine with Fact-type and Activity-type complement clauses. A subset of them *(recognize, discover, find)* only combines with Fact-type clauses.
- **Verbs of thinking** divide into four subgroups: *think, consider, imagine, dream,...* combine with Fact- and Activity-type clauses; *assume, suppose,..* only with Fact-type clauses; *remember, forget,...* with all three complement clause types, yielding different meanings; and *understand, know, believe, suspect,...* with Fact- and Potential-type complement clauses.
- **Decision verbs** *(decide, resolve, plan, choose...)* take Fact- and Potential-type clauses.
- **Verbs of liking** *(like, love, prefer, regret, favor,...)* combine with Fact- and Activity-type complement clauses. One specific predicate of liking, namely *enjoy*, can only combine with Activity-type clauses.
- **Verbs of speaking** form the last group and this group again divide into several subclasses: *say, inform, tell,...* combine with Fact-type clauses; *report* takes Fact- and Activity-type complements; *describe, refer to,...* only combine with Activity-type clauses; and *promise, threaten, order, command, persuade, tell,...* only with Potential-type complements.

Besides these lexical matrix predicates, there are secondary semantic types. Some concepts are always expressed as lexemes (like the verb classes above), whereas others are always part of grammar (like pronouns or syntactic function markers). However, according to Dixon (2010), there also secondary concepts which are in between those two. These are coded as grammatical forms in one language but as lexemes in another. To this class belong elements like *not, can, must, begin, try, want, hope, plan, make, help* which can be realized as an affix on the verb, as a secondary affix as part of the T/A/M system, as an independent element modifying the embedded verb/the whole complement clause, or as a lexical verb. The difference between full lexical verbs (listed above) and secondary elements is that the

latter modify a full predicate whereas the former are full predicates themselves. In examples like (7) (Dixon 2010, 400), the full predicate *write* is assumed to be modified by the secondary class predicate *begin*.

(7) John began [to write a detective story].

Secondary predicates are different from lexical predicates in that they are closer to grammatical functional markers than "regular" lexical elements. However, they behave similar to lexical verbs in restricting the complement clause type they combine with. Secondary predicates divide into three classes, differing in the number of allowed embedded arguments. The first group, *Secondary A*, does not add an argument to the complement predicate which means that the embedded clause cannot exhibit an independent subject. Typologically, Secondary A predicates are likely to be realized as an affix or grammatical modifier, however, in several languages they also appear as lexical forms. Dixon (2010) observes four different Secondary A subtypes: Negators *(not, never,...)* are realized as transitive verbs in some languages, taking Fact-type complement clauses; modals like *can, should or must* combine with Fact- and Potential-type clauses; beginning predicates *(begin, start, continue, stop, finish,..)* go with the Activity- and Potential-type; and lastly, predicates of trying *(try, attempt,...)* take Potential-type complement clauses.

The second group is called *Secondary B*. These predicates can but do not have toadd an argument to the complement clause configuration. Secondary B predicates are *want, wish for, hope for, intend, plan* and *pretend* and usually combine with Potential-type complement clauses, sometimes also with Fact-type ones.

Lastly, *secondary C* verbs demand an independent embedded subject, thus, the embedded clause cannot have the same subject as the matrix predicate. Predicates of this class are *make, cause, force, let* and *help* which combine with Potential-type complement clauses only.

To sum up, Dixon (2010)'s classification of complementation (the types of complement clauses and possible matrix predicates) yields a tripartite picture shown in Table (3). Individual languages vary in how many complement clause types they have. If a language has complement clauses, they adhere to the proposed tripartite classification. However, there are languages lacking complement clauses, replacing them with *Complementation Strategies* such as serial constructions, relative clauses or nominalizations.

Table 3: Complement clause types in Dixon (2010)

Complement type	Time reference	Matrix predicate
Fact-type	independent	**Lexical verbs**: *think, imagine, assume, remember, forget, know, understand, believe, discover, say, inform, report* **Secondary verbs**: *can, wish*
Activity-type	time reference often expressed by a lexical element	**Lexical verbs**: *see, hear, like, fear, enjoy, describe* **Secondary verbs**: *begin, continue*
Potential-type	dependent	**Lexical verbs**: *promise, threaten, order, persuade* **Secondary verbs**: *should, try, want, make*

3 Structural-grammatical approaches

Generative approaches employing structural-grammatical tools and concepts often follow what has been described as *formal generative typology* (Baker 2009, Baker & McCloskey 2007). Formal generative typology allows combining tools from both generative grammar and typology. To make informed claims about language variation and universals, insights from typology are indispensable. On the other hand, to investigate non-surface observable dependencies (e.g, between semantic and morphosyntactic properties), a significant degree of theoretical abstraction is necessary, for which generative grammar offers useful tools. Common to many *Government and Binding* and *Minimalism* approaches to complementation is the idea that syntax regulates, in one way or another, the distribution of complement clauses. Differences between control, raising, and ECM have been attributed to concepts of Case and/or clause structure (see for instance Pesetsky 1992 for a very rich study on complementation in English, or Landau 2000 for control cross-linguistically). In this section we summarize three formal generative approaches to clause structure and complementation which aim to derive complementation typologies from structural concepts. A shared concept of these approaches is that the structural makeup of clauses is the link between the semantic and morphosyntactic properties of complementation. However, the accounts differ regarding how direct the relation between syntax and semantics is.

3.1 Cartography

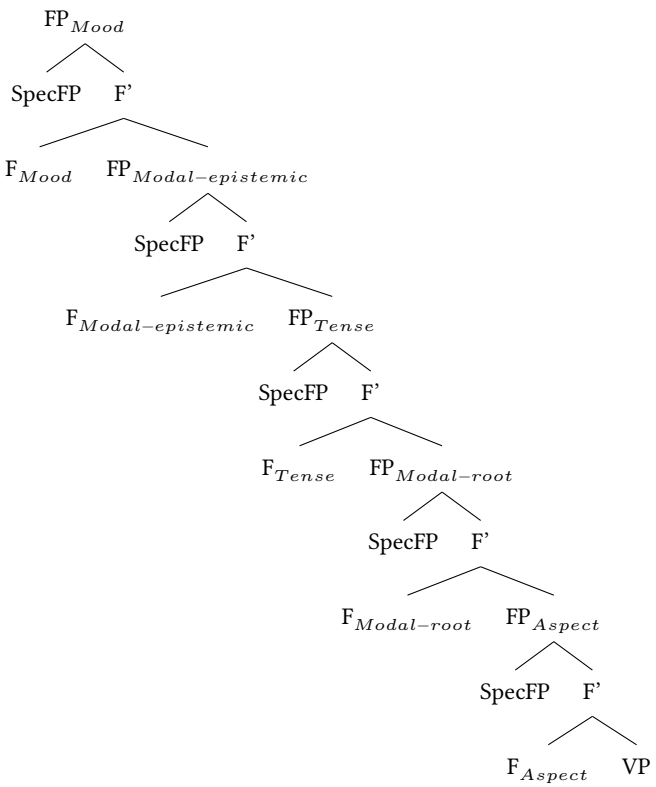
Cartographic approaches aim to represent semantic categories by syntactic structure. Sentences are assumed to involve a fine-grained hierarchical structure of functional projections, which are defined semantically, and the resulting *Functional Hierarchy* is hypothesized to be universal.[1] In Rizzi (1997), the left periphery is decomposed into information structural properties such as topic and focus, and syntactic constituents mapped to these functions must occur in these designated positions. The cartography proposed in Cinque (1999; 2004); Cinque & Rizzi (2010) involves a semantic hierarchy of clausal functions such as mood, tense, and aspect (see (8), from Cinque 2004 for the detailed hierarchy), which are mapped to functional projections in syntax. For each particular meaning, the functional head can realize an affix corresponding to that meaning, and the specifier a phrase expressing that meaning. Syntax thus reflects semantics in that each possible semantic interpretation receives its own syntactic projection. Although single languages do not realize all possible functional heads, the hierarchy is still assumed to be covertly present. Thus, for cartographers, the size of innate clause structure is rather large, providing more structure than needed in individual languages.

(8) Speech act » evaluative » evidential » epistemic » past » future » irrealis » alethic » habitual » repetitive » frequentative » volitional » celerative » anterior » terminative » continuative » retrospective » proximative » durative » generic/ progressive » prospective » obligation » permission/ ability » completive » VoiceP » celerative » repetitive » frequentative

The categories can be subsumed into the broader classes Mood > Modal (epistemic) > Tense > Modal (root) > Aspect, which resemble various hierarchies and semantic classifications in the typological approaches discussed. One difference is that cartographic approaches yield a rigid syntax–semantics mapping. Each semantic category corresponds to its own functional head, resulting in a highly detailed syntactic structure. Cartography thus describes the maximal size of functional structure possible in a language and larger configurations cannot be generated as simple clauses but must involve embedding of an entire new clause. A reduced version of the cartographic *Functional Hierarchy* is shown in the structure in (9).

[1] Note that in this section "functional" refers to the part of clause structure that is above the lexical projection of a head; e.g., the functional IP, as opposed to the lexical VP.

(9)



The main motivation for the *Functional Hierarchy* comes from the surface ordering of the elements associated with the functional heads, which is highly uniform across languages, for some categories universal. This is best known for adverbials. In Cinque (1999) it is shown that adverb orders show significant similarities cross-linguistically, and it is suggested that adverbs occupy specifier-positions along the *Functional Hierarchy* (SpecFP in (9)). The position of different adverbs is determined by the meaning, matching with the categories of the semantic classes in (8).

In Cinque (2004) an extension of the adverb hierarchy to (some aspects of) complementation is provided. Based on the observation that affixes, auxiliaries, functional particles, and certain verbs also show consistency in their ordering, it is suggested that not only affixes, but also auxiliaries and verbs occupy positions along the *Functional Hierarchy*. This yields monoclausal structures for certain complement configurations, thus syntactically representing that these complements can be integrated directly into the matrix clause.

Although the *Functional Hierarchy* in Cinque (1999; 2004) covers only the as-

pects of complementation that can be related to Clause Union or functional Restructuring (Rizzi 1976; 1978; see Wurmbrand 2001; 2004 for an overview and references), it shows surprising similarities to the *Binding Hierarchy* in Givón (1980), which suggests a deeper connection and possible extension to complementation in general. Both hierarchies are defined by semantic categories, although with a different level of detail. Givón (1980)'s hierarchy includes *weak epistemic, strong epistemic, emotive low, emotive high, strong attempt, and implicative*, which is a subset of Cinque (2004)'s hierarchy in (8). Importantly, the hierarchical order of the categories is the same in both approaches. It may thus be possible to implement the observed mapping generalizations via the cartographic *Functional Hierarchy*: the higher an element is on the hierarchy, the more structure is contained below it and the less dependent the configuration may be. One approach that has implemented core cartographic insights and applied them to (non-monoclausal) complementation is presented in Sundaresan (2012; 2018). It is shown there that the cross-linguistic distribution of indexical shift follows the implicational hierarchy (from high to low) Speech > Belief > Evidential/Knowledge: whenever a language allows indexical shift in a lower type of complement clause, it also allows it in a higher type of complement. This implicational universal relation is derived via cartographic containment relations of structure together with the option of differently sized complement clauses—the higher a verb is on the hierarchy the larger its complement clause would be.

In the following section, a reduced cartographic approach will be presented, which will then lead to a theory of complementation that combines the insights of many of the approaches discussed so far, both functional-typological and structural-grammatical.

3.2 Ramchand and Svenonius 2014

Ramchand & Svenonius (2014) address a tension between cartographic approaches which, as laid out above, employ rigid clausal templates with a rich inventory of ordered projections, and minimalist approaches, which often utilize the concept of free Merge and disfavor predetermined templatic clause structure. Ramchand and Svenonius conclude that there is an irreducible part of clause structure, which is stable across languages, however instead of an array of functional projections it consists of only three broad clausal domains which are in a containment configuration. This universal hierarchy of functional domains is semantically determined and a residue of cartographic structure, but since it can be externally motivated, it is also compatible with minimalist tenets. Ramchand and Svenonius's approach to clause structure hence unifies the advantages of both

cartographic and minimalist approaches, since the clausal hierarchy as defined is minimal and (largely) predictable, but clausal computation is also not entirely free.

The Ramchand and Svenonius hierarchy consists of three broad clausal domains which are defined semantically as *e(vent), s(ituation)* and *p(roposition)*. These semantic 'sorts' are seen as conceptual primitives, which map uniformly to syntactic structure: the semantic *e*-sort corresponds to the syntactic *v*/V-domain, the semantic *s*-sort to the syntactic T-domain, and the semantic *p*-sort to the syntactic C-domain. Although the three broad domains are hypothesized to be universal, within these domains, there could be language-specific, individual ordering (contra cartographic approaches).[2] Importantly, the three domains are in containment configurations such that higher domains are elaborations of lower domains: *p* is built from *s*, and *s* is built from *e*. The definitions and computational makeup of the three domains are as follows.

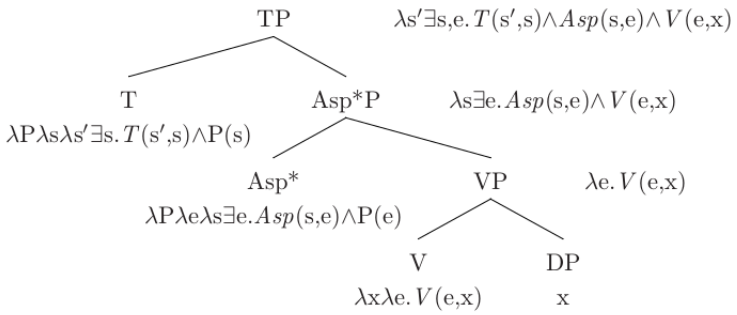
- ***Events*** form the syntactic domain *v*/VP. Within the *event*, thematic roles are assigned and the single components, namely participants and subevents, are bound together. In particular, causation and resultativity unite subevents into a single, complex event. Events can be stative or dynamic, they can be quantified over and have no temporal information (see (10); Ramchand & Svenonius 2014, 16).

(10) $[\![[_{VP}\, verb]]\!] = \lambda e.\textsc{verb}(e)$

- ***Situations*** form the syntactic domain TP (or equivalent label). They are created by combining an *event* with time- and world-parameters, allowing them to refer to specific times and worlds. A *situation* is an elaboration of an eventuality and thus presupposes the existence of an *event*, making it necessarily more complex than an *event*. The semantic computation of an entire *situation* is given in (11). As shown, in order to build a *situation*, an *event* has to be existentially closed and transferred to the next domain. The transfer point is the functional head Asp* which combines with an existentially closed *event* and renders a situational description with an aspectual parameter. Then, Asp*P is combined with a temporal head (such as T), which adds a tense parameter and fully converts an *event* into a *situation*.

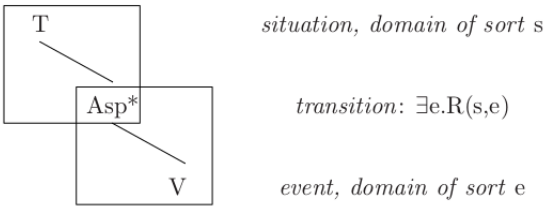
[2] The resulting clausal organization is very similar to the three 'prolific' domains developed in Grohmann (2003)—theta-domain, phi-domain, and operator-domain.

(11) Ramchand & Svenonius (2014), 19:



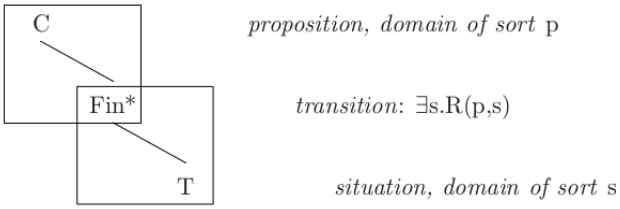
More schematically, the composition is given in (12), illustrating the core components of creating a *situation* from an existentially closed *event*, with aspect being the transitional area between the two semantically defined clausal domains.

(12) Ramchand & Svenonius (2014), 19:



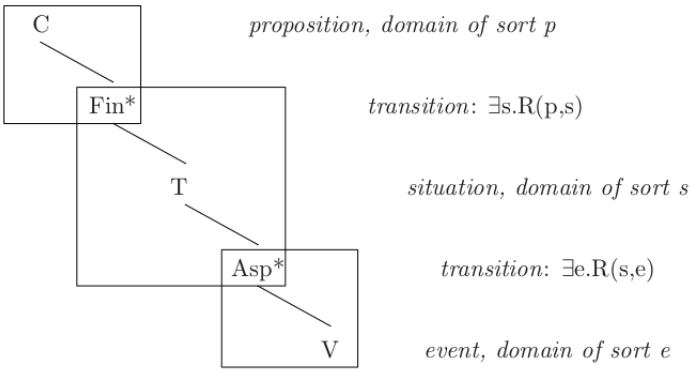
- ***Propositions*** correspond to the syntactic CP-domain. They are created by combining an existentially closed *situation* with speaker-oriented parameters, which anchors the *situation* to an utterance-context. A *proposition* is thus an elaborations of a *situation*, presupposing its existence. As show in (13), the transfer point between a *situation* and a *proposition* is given as Fin* (or a similar head above T), which adds a temporal or a world parameter to a *situation*, making it speaker-oriented and anchored in the discourse.

(13) Ramchand & Svenonius (2014), 20:



The diagram in (14) presents the full picture. The three sortal domains, *event*, *situation* and *proposition* are built in a way that higher sorts are expansions of lower sorts, with certain syntactic functional heads acting as transition points. *Events*, which are timeless eventualities, combine with Asp* and T, rendering a *situation* with tense and world parameters. *Situations*, which are time-specific eventualities, combine with Fin* and C, yielding a *proposition* with discourse anchoring.

(14) Ramchand & Svenonius (2014), 21:



A significant benefit of this model is that, in contrast to cartographic hierarchies, the containment relations are not stipulated but follow from the semantic composition. The most important insight lies in the way syntax and semantics interact. Although there is a tight connection between the syntactic domains and the resulting semantic sorts, the relation is not a one-to-one relation. The broad domains are uniform (e.g., to create a configuration that is interpreted as a *situation*, the TP-domain must be present). However, the internal composition of these domains, as well as the specific heads that make up the domains in any given language (or sentence), may vary, as long as some basic heads responsible for transition and elaboration into higher sorts are present. The resulting hierarchy of clausal domains is basic enough to be learnable, and flexible enough to allow for language variation. Nevertheless it imposes universal restrictions which explain the patterns found cross-linguistically.

Although the proposal in Ramchand & Svenonius (2014) is not designed as a model for complementation but has as its goal a theory of basic clause structure, we show in the next section that it can be extended directly to complex clauses and that the hierarchy observed for clausal domains in simple clause is replicated

in the complementation hierarchies that have been observed in the typological works in one way or another.

3.3 Wurmbrand and Lohninger 2019

Wurmbrand & Lohninger (2019) propose a formal generative typology approach to complementation which can be seen as the structural-grammatical counterpart to Givón (1980)'s *Binding Hierarchy*. Both works follow the hypothesis that there is a possibly universal implicational complementation hierarchy which is defined semantically and detectable through a diverse set of grammatical properties. While the distribution of morphosyntactic properties varies significantly across languages, the semantic grouping of complement types shows a (more) stable distribution. The core observation in Wurmbrand & Lohninger (2019) is that the categories of the implicational complementation hierarchy [ICH] can be defined as *Propositions*, *Situations*, and *Events*, adopting the terminology and definitions in Ramchand & Svenonius (2014) (similar classifications have been proposed in Rochette 1988; 1990, Pesetsky 1992 under different labels). These three semantic types are supersets of the categories suggested in Givón (1980) and align with the hierarchy given there. Since the three-way distinction has been robustly attested across languages, whereas the division into sub-classes shows variation, the ICH is defined only for these broad classes. The main properties of the three ICH categories are as follows.

- ***Proposition*** complements comprise of speech and epistemic contexts (possibly also factive complements). *Proposition* complements can be assigned a truth value (*Nova claimed that she bought salad, which is true*—i.e., it is true that she bought salad) or have a presupposed truth value (as in the case of factive complements). Furthermore, *Proposition* complements are temporally independent in that the embedded state of affairs can occur simultaneously to, before, or after the matrix event. The freedom of the embedded time-reference comes from the fact that the complement clause has its own utterance context which anchors the embedded tense. Lastly, *Proposition* complements may involve speaker-oriented parameters, an independent embedded subject, and partial control (see Landau 2000). Matrix predicates typically combining with *Proposition* complements are *admit, affirm, announce, assume, believe, claim, consider, discover, figure, find, forget* (factive), *imagine, know* (factive), *observe, say, suppose, tell* (speech), *wager*.

- ***Situation*** complements, which involve emotive, irrealis, and possibly other types of complements, refer to eventualities that are not evaluated for truth but for properties of the content (*Nova asked me to buy salad, which is a good idea/not*

easy to do on Sundays—i.e., to buy salad is neither true nor false but can receive a speaker assessment of the content of the eventuality). *Situation* complements elaborate eventualities without speaker- or utterance-oriented properties. However, they show time- and world-parameters and refer to a specific, possibly predetermined, time. The most common type of *Situation* complements are unrealized irrealis events (such as 'to decide to do something'; i.e., the decision is to bring about a not yet realized situation) in which the time of the complement clause is set in the future with respect to the matrix time. Lastly, *Situation* complements often allow partial control. Matrix verbs combining with *Situation* complements are *agree, ask, choose, decide, demand, desire, know* (modal), *need, plan, promise, refuse, tell* (imperative), *want, wish.*

- ***Event*** complements involve implicative and strong attempt contexts. *Event* complements lack speaker- and utterance-properties, as well as world- and time-properties. These types of complements are therefore tenseless (the embedded eventuality occurs simultaneously with the matrix event and in contrast to *Situation* complements, cannot refer to a time in the future). Furthermore, *Event* complements may have reduced argument structure and/or event properties, and typically trigger obligatory exhaustive control. Matrix verbs which take *Event* complements are *avoid* (implicative), *begin, can, continue, fail, finish, forget* (implicative), *manage, may, must, start, stop, succeed, try.*

The temporal and subject properties are summarized in Table 6. While languages may display finer-grained distinctions, the three broad classes in Table 6 are reflected, in some form or another, in all typologies summarized in this article. Importantly the classes are defined semantically and not necessarily by specific matrix verbs. Certain verbs can occur in more than one context, such as factive vs. implicative *forget*, factive vs. modal *know* or speech vs. order *tell*. Depending on the meaning, these verbs would thus be in different classes, and their properties *under a particular interpretation* follow (only) the properties of the class associated with that interpretation. Thus, the tripartite classification in Table 6 is about the semantics of complementation configurations, not about specific verbs, nor about syntactic properties of the complement clause.

Table 4: Complement clause types (Wurmbrand & Lohninger 2019, 12)

Properties	***Proposition***	***Situation***	***Event***
Temporal interpretation	embedded reference time; no pre-specified tense value; anchored in an utterance or embedding context; may involve speaker-oriented parameters	no speaker/utterance properties; no embedded reference time; pre-specified tense value (most common future, modal)	no speaker/utterance properties; no time and world parameters; tenseless, simultaneous
Type of control	partial control possible	partial control possible	exhaustive control

A main property of the three semantic types of complements is that they stand in a hierarchical relation with each other as illustrated in Table 5. Independence refers to properties such as the presence and/or interpretation of an independent subject or tense in the embedded clause. Transparency describes the permeability of the embedded clause for certain operations or dependencies. Integration is the degree to which the embedded predicate is an integral part of (e.g., incorporated into) the matrix predicate. The implicational nature is reflected in the scale arising from the hierarchy: *Proposition* complements are more independent, less transparent, and less integrated than *Situation* complements, which in turn are more independent, less transparent, and less integrated than *Event* complements.

Table 5: *Implicational Complementation Hierarchy* (ICH) (Wurmbrand & Lohninger 2019, 6)

Most independent		Least independent
Least transparent	*Proposition* > *Situation* > *Event*	Most transparent
Least integrated		Most integrated

The three-way distinction is motivated by a range of what Wurmbrand Lohninger refer to as *ICH-Signature* effects, which can be observed within and across languages: when a property distinguishes between different types of complements, *Proposition* and *Event* complements show the opposite values, and *Situation* com-

plements either allow both values or 'side' with one or the other. ICH-signature effects have been observed for a range of morphosyntactic and semantic properties. An illustration is given in Table 6 for the distribution of clause introducers in Greek and Bulgarian. These languages lack infinitives and all complement clauses are realized as finite, introduced either by *oti/na* (Greek) or *če/da* (Bulgarian). The distribution of the introducers is not random, however, but shows the ICH-signature: *Proposition* complements obligatorily require *če/oti* whereas *Event* complements only allow *da/na*. *Situation* complements permit both option.

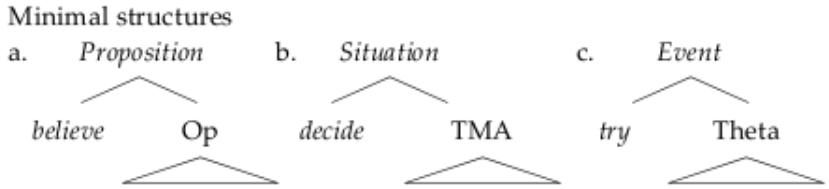
Table 6: Clause introducers in Greek and Bulgarian, ICH-signature (Wurmbrand & Lohninger 2019, 13)

	Proposition	***Situation***	***Event***
Bulgarian	*če, *da*	*če* (+FUT), *da*	**če, da*
(Cypriot) Greek	*oti, *na*	*oti* (+FUT), *na*	**oti, na*
***ICH*-signature**	+P	+/-P, + P, -P	-P

The mapping between the hierarchy and morphosyntactic properties of complement clauses is not absolute but relative. How independence, transparency and integration are manifested in different languages varies and there are no universal morphosyntactic properties that can be associated with any of the different classes of complements. However, there are implicational relations—for any independence property (e.g., complementizers, finiteness), a type of complement can never be more independent than complements of the classes to its left. While in certain *Government and Binding* approaches, (non-)finiteness is seen as a defining characteristic for particular clause types and structures (e.g., ECM and subject raising clauses must be non-finite in English), the ICH model does not prescribe a strict mapping between finiteness (or other morphosyntactic properties) and specific types of complements. While there is a cross-linguistic tendency for *Proposition* complements to be finite and *Event* complements to be non-finite, this is not universally the case, and non-finite *Proposition* complements as well as finite *Event* complements are possible as well in certain languages. The distribution is not entirely arbitrary, however, but follows the ICH indirectly. As shown in Wurmbrand et al. (2020), a type of complement can never be more finite than the complement(s) to its left on the ICH. This implicational universal is derived by finiteness being the realization (not the cause or trigger) of different syntactic structures associated with different ICH categories.

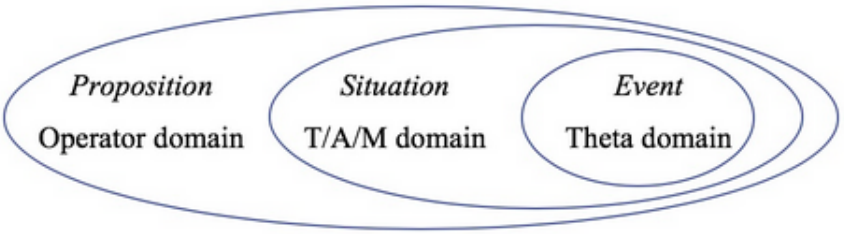
While there is no direct connection between the ICH and morphosyntactic properties, Wurmbrand & Lohninger (2019) propose that there are mapping restrictions between them. Classifying complement clauses in terms of the conceptual primitives and sorts defined in Ramchand & Svenonius (2014) (see the previous section), an (in)dependence scale automatically arises: *Propositions* are most independent, as they are anchored in an utterance/embedding context and contain time and world parameters; *Events* are most dependent as they lack all T/A/M and context parameters; and *Situations* are in-between since they contain T/A/M but no context parameters. Furthermore, adopting the syntax–semantics mapping modeled in Ramchand & Svenonius (2014), a syntactic complexity scale can be defined, which yields different *minimal* structures for the three types of complements, as illustrated in (15).

(15) Wurmbrand & Lohninger (2019), 33



Finally, the system predicts the implicational relations among different clause types by the same containment configurations found in simple clause structure: *Situations* are elaborations of *Events*, and *Propositions* are elaborations of *Situations*, as illustrated in (16).

(16) Wurmbrand & Lohninger (2019), 32



Proposition, *Situation*, and *Event* complements may thus differ in structural size (in addition to different semantic complexities). However in contrast to cartographic approaches, this mapping is not absolute and, as long as the relevant

semantic relations are maintained, the syntactic structure can also lead a partially independent life. This autonomy of syntax is an important concept, since there is variation across languages in the structure of complement clauses with the same meaning. In particular, the system allows variation in the composition of the clausal domains as well as complement clauses to grow larger than the minimally required structures in (15). The only restriction is that structures cannot be too small or lacking crucial components to yield the desired output. For instance, to create a configuration that is mapped to a semantic *Situation*, the complement needs to contain some property of the T/A/M domain. However, it is not prescribed how this parameter is expressed—it can be added by various syntactic operations like tense, modality or aspect. Similarly, it is also possible to add an operator domain, as long as the resulting configuration can still be interpreted as a *Situation*. Hence, there is no one-to-one correspondence between meaning and syntactic structure, but different structures can, in principle, map to the same semantic concept.

The (partial) autonomy approach of syntax is paired with what Wurmbrand & Lohninger (2019) refer to as a *synthesis model* of complementation. In contrast to cartographic approaches, the model is compatible with a *free merge* system, where the compatibility of verb-complement configurations is determined at the output (when syntax feeds into semantics). The specific hypothesis is that complementation configurations are computed freely in syntax and that the semantic output is determined jointly by the specifications imposed by the matrix predicate and the complement. A semantic counterpart of this model can be found in semantic decomposition approaches (see Kratzer 2006, Moulton 2009b,a), where it is suggested that the meaning of attitude contexts is 'spread' over the matrix and embedded clause and aspects of the attitude meaning are attributed to the embedded complementizer rather than the matrix verb. A crucial aspect of the synthesis approach is that in complementation the influence is mutual—a matrix verb can impose properties on the embedded clause, but properties of an embedded clause can also affect the matrix predicate. An area where complement influences on the matrix predicate have been observed involves alternating verbs such as *tell, forget*, or *know*, which in many languages occur in two frames. To illustrate, *tell* has a speech meaning (*I told him that she left*) or an irrealis command meaning (*I told him to leave*). Importantly, different meanings often correlate with different morphosyntactic coding: in English (and many other languages), the speech meaning occurs with a finite complement whereas the infinitive has only the command meaning; in Greek, Bulgarian, or Macedonian, different clause introducers are used for the two meanings. The synthesis model opens the door

for an approach which avoids duplicating these verbs. Instead of assuming that there are two verbs *tell, know, forget*, etc., these verbs have an underspecified semantics and freely combine with different types of complements. Depending on which type of complement is chosen, which is often reflected in morphosyntactic coding differences, different meanings are computed (i.e., the type of complement dynamically contributes to the meaning of the matrix predicate). An open question is how exactly the meaning of these verbs can be characterized to allow the flexibility to yield different combinatorial meanings when combining with different types of complement clauses.

The effect of synthesis is also observed in class switches where verbs are shifted into different interpretations based on the composition of the embedded clause. An issue researchers have encountered especially in field research on complementation is that speakers sometimes allow verbs to be reinterpreted and coerced into a different meaning, in particular when forced by morphosyntactic coding that points to a different complementation class. For instance, the verb *decide* typically requires a future irrealis complement, even when it occurs with a finite complement: *I decided to leave/that I would leave* are possible, but *I decided to have left/that I/she left* are very odd. However, in some contexts, *decide* can be coerced into an attitude meaning, such as the performative use in cases like *I decided that he is a nice person* where the matrix subject evaluates or assigns truth to the embedded proposition (other attitude meanings are possible for some speakers as well). Whenever class switches are possible, the resulting configurations obey the ICH and the properties exclusively follow the properties of the switched into class. For instance, a (regular) *decide* configuration with an irrealis interpretation shows the properties of *Situation* complements, whereas configurations with a (coerced) attitude interpretation follow the properties of *Proposition* complements. The extent of such class and meaning switches is not known yet, and further research is necessary to determine the cross-linguistic distribution of (im)possible class switches and their semantic and morpho-syntactic properties.

4 Variation and universality

As the above summaries have shown, examining complementation from different vantage points renders a heterogeneous picture. Approaches to complementation differ depending on the focus, theoretical setting, methodologies employed, and goals of an account. The resulting classifications vary from very rich and detailed sets of verb classes and complement clause types to more reduced and

abstract inventories. These differences, among others, reflect the tension between universality and variation: coarse classifications with broader classes and hence fewer categories as in Cristofaro (2005), Ramchand & Svenonius (2014) or Wurmbrand & Lohninger (2019) apply to more languages and are easier to observe cross-linguistically; rich and fine-grained classifications as in Givón (1980), Noonan (2007), Dixon (2010) or Cinque (1999; 2004) cover more language-specific properties, but are less suitable to describe cross-linguistic patterns. In the first part of this section, we summarize some points of variation found across languages as well as differences in the theoretical conclusions reached in the accounts presented in this chapter. In the second part, we show that there are nevertheless also many encouraging similarities which can be extracted from the different approaches.

4.1 Variation and differences

The works on complementation have brought to light a wealth of interesting facts, observations, and generalizations. Unfortunately, not all of the patterns observed are uniform across languages and many only express cross-linguistic tendencies. Natural languages often behave heterogeneously when it comes to clausal complementation, and especially morphosyntactic properties may show language-specific idiosyncrasies and cross-linguistic variation. Thus, building a framework covering complementation universally is a difficult task and, as seen in this chapter, can have different outcomes.

Two core concepts found in most works on complementation are T/A/M-marking and (in)dependence of the embedded subject, however, accounts differ regarding the significance of these concepts in shaping a theory of complementation. To illustrate, Givón (1980) for example provides a classification based on subject dependence, whereas Noonan (2007) builds an account based on T/A/M-marking and time-reference. The two approaches lead to complement clause systems which do not only differ in their number of complement clause types but also in their distribution. The third main concept of most accounts is that complement clauses differ in the degree of clausehood—complements may be full clauses or be reduced in some way. However, as we will see, there is no agreement on how notions such as 'clausehood' or 'reduced clauses' are defined. Since complementation is an interplay of clausehood, semantics (of the matrix verb and/or the complement clause) and morphosyntactic coding, a multitude of analytical options arises, depending on the definitions of these concepts and their interactions. In what follows, we summarize differences and issues arising for T/A/M-marking, subject (in)dependence, the definition of clausehood, and the

classifications of matrix verbs. We conclude that T/A/M-marking restrictions and (in)dependence properties of the embedded subject are not sufficient to define complement clause types, and neither does there seem to exist a uniform definition of (reduced) clausehood that applies across frameworks. Morphosyntactic marking and subject dependence show certain tendencies in the distribution of complement clauses, but are not rigidly aligned with different complement types or the semantics of complementation configurations.

T/A/M-marking plays a core role in many typologies and approaches to complementation. The concept of 'reduced clausehood' overlaps and is sometimes even seen as equivalent with the notion of 'reduction of T/A/M-marking'. Givón (1980) claims that the higher a complement clause is on the *Binding Hierarchy*, the more reduced its T/A/M-possibilities are. Dixon (2010) uses T/A/M-marking as a defining criterion for complement clause types: one class has full, one reduced and one no T/A/M-possibilities. Similarly, Cristofaro (2005) proposes that complement clauses either have independent, predetermined or irrelevant T/A/M-specifications, rendering three complement clause options. Lastly, Noonan (2007) employs finiteness as a defining criterion: fully specified indicatives or partly specified subjunctive form s-like complements, whereas infinitives are reduced complement clauses.

While the resulting three-way distinctions suggested in the different accounts (clauses with full T/A/M-marking, some T/A/M-marking and no or very little T/A/M-marking) are suggestive and seem to present a clear cross-linguistic tendency, reduction in T/A/M-specifications is not a universal property of complement clauses. It is not always the case that languages have different T/A/M-possibilities for different types of complements. For example, in languages like Greek, Bulgarian, and Macedonian (and many others), all complement clauses are finite and none of them has reduced T/A/M-marking. However, as shown in Wurmbrand & Lohninger (2019); Wurmbrand et al. (2020), these languages still have different complement clause types, as is observable by the distribution of clause introducers. Similarly, complementation differences have been widely observed, even in languages without tense or agreement marking. A related controversy concerns the concept of 'finiteness'. Due to the extensive cross-linguistic variation in the distribution of finiteness, many works have concluded that there is no single morphosyntactic definition of finiteness, nor a single semantic function associated with it (see e.g., Cristofaro 2007, Bisang 2007, Nikolaeva 2007a). Among the morphosyntactic categories that have been suggested to reflect finiteness in different languages are tense, aspect, mood, illocutionary force, person

marking, politeness, special forms not used in independent clauses, and/or nominal morphology on the verb (see the works in Nikolaeva 2007b). Although finiteness often reflects different degrees of clausehood, there is no specific feature or property of finiteness that applies cross-linguistically and that could be used to classify different types of complements.

Thus, using only morphosyntactic criteria to divide complement clauses into different classes does not yield a uniform picture cross-linguistically as there is a significant amount of variation in the distribution of morphosyntactic coding of complement clauses. Language may or may not use morphosyntactic strategies to mark different types of clauses, and even for languages that do display differences, the strategies are diverse and not uniform: some languages use various degrees of reduced T/A/M-marking, other languages distinguish complement classes solely via properties of the subject, and yet others may code complement clauses in entirely different ways. Reduced T/A/M-possibilities, and morphosyntactic coding options in general, are all valid, efficient ways to distinguish between complement clause types. However, they are largely language-specific and most likely only the surface reflection of a deeper, more abstract division of complement clause types. What can be concluded, however, is that if a language makes use of T/A/M-reduced complement clauses, their degree of reduction aligns with complementation hierarchies as developed in the different accounts.

The second main characterizing property of different types of complement clauses is the **independence of the embedded subject**. Phenomena related to subject (in)dependence are diverse and often form (one of) the defining criteria for the classification of different complement clause types and their semantic integration into the matrix clause. Noonan (2007) suggests that raising and equi-deletion are both instantiations of dependent subjects, which yield non-s-like complement clauses. Infinitives always lack a subject, whereas finite (s-like) complement clauses always have one. Having no subject is thus equivalent to clauses being reduced. Givón (1980)'s *Binding Hierarchy* is based on a (functional) dependence between the embedded and matrix subjects: the more influence the matrix subject has over the embedded subject, the more integrated the complement clause is into the main clause and the higher the verb is on the semantic *Binding Scale*. Furthermore, Dixon (2010) uses subject dependence as defining criterion for complement clause classes, and Cristofaro (2005) argues that the determination of the embedded subject is fully dependent on the matrix predicate.

Most approaches relate subject (in)dependence to clause reduction—if the sub-

ject is dependent on the matrix predicate, the embedded clause is reduced in some form and tends to show less specific T/A/M-marking. However, similar to T/A/M-reduction, subject-dependence is not a universal indication of clause reduction, nor a reliable tool to distinguish between complement clause types cross-linguistically. While it is common that certain types of complements tend to require an interpretation in which the embedded subject is either not present or identical to the matrix subject, the morphosyntactic instantiations associated with subject (in)dependence (case marking, agreement, control or equi-deletion, ECM, raising to subject or object) show wide variation. Phenomena such as raising to subject or object, or ECM may indicate clause reduction in some languages since they are only possible with infinitival complements (Noonan 2007 or Givón 1980), but this is not the case universally. ECM (or raising to object) from a finite (i.e., non-reduced) complement clause as in the Turkish example in (17) is found in several languages (see Wurmbrand 2019 for an overview).

(17) John [**makarna-yı** ye-n-di di-ye] duy-du.
John.NOM [pasta.ACC eat-PASS-PST COMP] hear-PST
'John heard that pasta was eaten.' (Şener et al. 2011)

Similarly, the claim that subject raising always renders a non-s-like reduced clause (Noonan 2007) is contradicted by languages like Brazilian Portuguese, and others, where, as shown in (18), raising applies from a finite clause which remains fully specified even without its subject.

(18) **Os meninos** parecem [que fizeram a tarefa]
the boys seem.3.PL [that did.3.PL the homework]
'The boys seem to have done their homework.' (Nunes 2009)

Lastly, even control/equi-deletion has been shown to not being restricted to infinitives but possible in finite non-reduced complements as well (see Landau 2004 for an overview). Thus, subject dependence is often linked to clause reduction, but it is only a tendency. Similar to T/A/M-marking, it is a way for individual languages to distinguish between their complement clause types, but it is not a universal tool.

Although most approaches to complementation employ the concept of clausehood, the **definitions of clausehood** are not uniform. Basic questions such as how to define a clause, what a complement clause is and what does not count as a clause anymore, or where the threshold between monoclausal and biclausal structures is often remain open. Givón (1980) and Noonan (2007) for example include

nominalizations into the set of complement clauses whereas Dixon (2010) does not. Noonan (2007) analyzes serial verb constructions as complement clauses, but Dixon (2010) puts them into the set of complementation strategies, not complement clauses. Givón (1980) considers Clause Union and predicate raising to be a complement clause construction whereas Noonan (2007), Dixon (2010), and Cinque (2004) analyze them as monoclausal structures.

Another difficulty and area of disagreement concerns the definition of 'monoclausal' and 'biclausal'. Cinque (2004), for example, distinguishes between lexical and functional verbs, the former occurring in biclausal complementation configurations, the latter in monoclausal configurations. Functional verbs (such as modal, aspectual and motion verbs) are assumed to be located in the functional spine of a clause (TP or IP), and the "complement" is the main lexical predicate of the clause (VP, *v*P). Such functional Restructuring thus creates a truly monoclausal and mono-predicate configuration which, for all intents and purposes, behaves like a simple clause with a single predicate. This view, and a binary clausehood distinction in general, is challenged in Wurmbrand (2001; 2004); Wurmbrand & Lohninger (2019), where it is argued that monoclausality comes in several forms and degrees: functional Restructuring, lexical Restructuring with TP- and CP-less complements, and lexical Restructuring with CP-less complements.

Furthermore, the works on complementation have brought out that the distinction between 'functional' and 'lexical' verbal elements is not sufficient, and that there are also in-between cases. Dixon (2010) observes that some verbal elements referred to as secondary semantic types (among them *can, must, begin, try, want, hope, plan, make, help*) behave like functional elements in some languages, but as lexical elements with certain functional behavior in other languages. Noonan (2007) describes the same phenomenon as Clause Union where the matrix predicate (usually a manipulative verb) is unified with the embedded predicate, creating a monoclausal structure where the matrix verb becomes a kind of functional appendix to the embedded lexical verb. Finally, Wurmbrand (2001) and Wurmbrand & Lohninger (2019) observe that, in addition to fully lexical and fully functional verbal categories, there are also semi-lexical/semi-functional verbs (e.g., causatives and perception verbs), which occur as part of the functional clausal spine but nevertheless show certain thematic properties usually reserved to lexical verbs.

Thus, the definition of clausehood is not only important for the composition of the complement clause but also for the type of matrix predicate. While there is overall agreement that some predicates do not form their own clause but are

a part of the complement clause (or the complement clause is part of the matrix predicate), the details and definitions vary in the different approaches.

Given the diversity of the theoretical frameworks investigating complementation, the tools, strategies, and grammatical primitives of the different approaches diverge significantly, and as a result the definitions of **matrix verb classes** that trigger complementation also show some degree of variation. All accounts observe that there are different semantic classes of matrix predicates taking complement classes, however, the number of classes singled out varies in different accounts. Some accounts give coarser classifications, others more detailed ones, depending on the empirical scope, as well as theoretical focus of the different studies. Givón (1980) bases the classification on the emotional commitment of the matrix agent towards the complement proposition and distinguishes six types (*implicative, strong attempt, high emotive, low emotive, attitude, epistemic*). Noonan (2007) proposes a finer-grained division into 13 classes based on the meaning of the matrix predicates (*utterance, propositional attitude, pretence, commentative, knowledge, fearing, desiderative, manipulative, modal, achievement, phasal, immediate perception, conjunctive*). Cristofaro (2005) adopts these 13 types but further groups them into seven classes (*modal, phasal, desiderative, manipulative, perception, knowledge, utterance*). Dixon (2010) distinguishes five types of semantic classes of lexical verbs (*attention, thinking, deciding, liking, speaking*) and three types of secondary semantic classes involving semi-lexical/functional verbs. Finally, Wurmbrand & Lohninger (2019) suggest that there are only three general classes of matrix predicates (*Proposition, Situation, Event*), with possible further language-specific subdivisions.

An interesting phenomenon mentioned in most accounts is the possibility of double membership of certain verbs. Since matrix verb classifications are based on the semantics of a verb, verbs with more than one meaning are assigned to different classes, depending on the interpretation used. A generalization observed in Wurmbrand & Lohninger (2019) is that when a verb has alternating meanings, the morphosyntactic coding of the complement clause tends to correspond to different meanings. For instance, the verb *tell* in English can combine with either a finite or non-finite complement. However, the two configurations yield different interpretations: combined with a finite complement as in (19a), *tell* can only be interpreted as a speech verb, whereas an infinitival complement as in (19b) leads to a command interpretation of *tell*.

(19) a. I told her that I opened the window.
b. I told her to open the window.

Wurmbrand & Lohninger (2019) suggest that such patterns indicate that there is mutual influence between the matrix predicate and the embedded clause. It is not solely the matrix predicate that determines the properties of the complement clause, but the complement clause can also affect the meaning of the matrix predicate.

The last concept to compare concerns the **linking of semantics and morphosyntax**. Most accounts propose that the semantics of the matrix predicate and the morphosyntactic form of the complement clause are more or less tightly linked. It has been observed that certain predicates tend to combine with reduced complement clauses whereas others typically combine with fully specified complement clauses. In Givón (1980) for example, the matrix verbs on the *Binding Scale* are rather rigidly linked with the degree of syntactic reduction on the complement clause (*Syntactic Coding Scale*). In Cristofaro (2005), different matrix predicate types only take complement clauses with certain syntactic layers. Thus, a certain predicate type only combines with a complement clause of a certain morphosyntactic size. In Cartography, each semantic category has a pre-specified syntactic location, thus the linkage is highly rigid.

A looser connection is assumed in Wurmbrand & Lohninger (2019) where it is proposed that there are minimal requirements for the (morpho)syntactic computation of different types of complement clauses, but mismatches are possible as well. While there are clear cross-linguistic tendencies between meaning and form in complementation configurations, these are not universal. Clause reduction, for example, as observed in Restructuring/Clause Union shows gradual behavior, which follows the semantic hierarchies of complementation. However, the link between the semantics of a configuration and syntactic clausehood is only indirect in that the cut-off point for Restructuring varies across languages. Clause reduction is also often optional and many languages allow complements to grow larger than needed for a strict semantics–syntax mapping. Similarly, morphosyntactic finiteness does not strictly correspond to specific matrix predicate classes. As shown in Wurmbrand et al. (2020), all types of complement clauses can be finite or non-finite in at least some language. Although the distribution shows many language-specific properties and the specific finiteness values are not predictable for the different types of complement clauses in any given language, certain implicational relations are. Thus the semantics–morphosyntax mapping is not absolute but relative, in that morphosyntactic properties align along the complementation hierarchies, but not in a rigid one-to-one fashion.

4.2 Universalities

Given the fundamental differences in frameworks and variation across languages, the question of what the common properties of complementation are and what theoretical observations and conclusions are shared among accounts can only be answered at an abstract level by setting aside many details. Broadly speaking, the properties that play essential roles in different accounts are morphosyntactic (usually T/A/M) marking distinctions of the embedded predicate, (in)dependence of the embedded subject, the distribution and restrictions of embedded time-reference, and the semantics of the matrix predicate. All accounts also assume some, possibly relative, linking relation between the morphosyntactic properties of the embedded clause and the meaning of the matrix predicate. As we have seen in the previous sections, however, the weight and relevance of these properties varies in different approaches. Nevertheless those are core concepts of complementation that are reflected in some way or another in all theories of complementation. In this section, we summarizes some of the similarities in complementation types, the dependency between the matrix verb and the meaning and form of the complement clause, and the hierarchical organization of complementation. Abstractly, the generalizations that hold across languages and frameworks are: i) the combination of different semantic classes of matrix predicates with different types of complement clauses typically yield three *complementation configurations*; ii) the semantics of the matrix predicate interacts with the semantics and (to some degree) the morphosyntax of the complement clause in a predictable manner; iii) the different complement types are in some sort of hierarchical relationship.

All accounts observe that matrix verbs form (more or less fine-grained) groups based on their meaning, which is related to the semantics of the embedded clause. By combining different classes of matrix verbs and different semantic and morphosyntactic types of complement clauses, generally three types of *complementation configurations* arise. Dixon (2010) classifies complement clauses into three classes in the first place and then divides matrix predicates depending on what complement clause class they accept. In Wurmbrand & Lohninger (2019), a three-way classification is suggested based on the meaning of the entire complementation configuration (the combination of the complement clause with the matrix predicate). Quite remarkable, the three classes can also be observed in accounts with more detailed classification systems of verbs and/or morphosyntactic coding options. Combining, for example, Noonan (2007)'s 13 matrix predicate classes with the two complement clause types proposed there (s-like and non-s-like), three classes emerge: matrix predicates which take s-like complements, those

which take non-s-like ones and those which take both. Similarly, in Cristofaro (2005), matrix verbs are divided into seven classes, and complement clauses into four levels. However, if combined, only three classes emerge: those verbs taking proposition-level complement clauses, those taking predication-level complement clauses and those taking predicate- and predication-level clauses. Thus, viewed from the cross-linguistic perspective, focusing on the combination of matrix verbs and embedded clauses, which Wurmbrand & Lohninger (2019)'s synthesis approach decidedly does, provides the crucial key to understanding a deep similarity across languages, despite the extensive variation found in the details.

A second observation that applies cross-linguistically is that the meaning of the matrix verb and the meaning (and to some extent also the form) of the complement clause are not independent of each other but work together to form a well-formed *complementation configuration*. Matrix predicates and complement clauses do not combine in an "anything goes" fashion, but there are restrictions. These restrictions consist of the meaning (and possibly other selectional restrictions) of the matrix predicate, the meaning of the complement clause, and, usually connected to the latter, the morphosyntactic coding of the complement clause.

Independently of the number of classes distinguished for matrix predicates and complement clauses, one property that is found in various instantiations in most works on complementation is the time-dependence between matrix predicates and embedded clauses. Complement clause types differ in how dependent their time-reference is in any given complementation configuration—some complements can be independent in that they can be interpreted as before, after or simultaneously with the matrix predicate; others receive an independent time reference, however, one with a pre-selected tense value; yet others are fully dependent on the matrix time and have no time reference on their own. Noonan (2007), for instance, divides complement clauses into independent time-reference (ITR) and dependent time-reference (DTR), which lead to three combinatorial possibilities: verbs combine only with DTR complements, only with ITR complements, or with either DTR or ITR. Cristofaro (2005) and Dixon (2010) propose that there a three options for embedded time-reference: no determination, future predetermination, and same time as matrix. According to them, predetermination of time-reference solely depends on the meaning of the matrix verb. Lastly, Wurmbrand & Lohninger (2019) also propose a similar three-way split (independent time-reference, embedded future or irrealis orientation, and no tense), but do not assume that the determination comes just from the matrix predicate. For a successful *complementation configuration*, the time restrictions and specifications

of both the matrix and embedded clauses must match. If there is a mismatch, the combination is either impossible, or, in certain cases the meaning may be shifted to accommodate the mismatch.

The last uniformity emerging across accounts of complementation is the observation that different types of complementation stand in a (usually implicational) hierarchical relation to each other. Givón (1980) develops the *Binding Hierarchy*, Cristofaro (2005) the *Hierarchy of Complement Clause Deranking*, Cinque (1999; 2004) the *Functional Hierarchy*, and Wurmbrand & Lohninger (2019) the *Implicational Complementation Hierarchy*. Despite differences in terminology and details, the common conclusion is that there is an implicational, scalar hierarchy which orders complementation types along a semantically determined scale. The hierarchies are typically also ordered along notions of clausehood such as (in)dependence and integration of the complement, and play a direct or indirect role in the mapping of semantic categories to morphosyntatic types of complements.

Noonan (2007) suggests tat the stronger the semantic bond between the matrix and the embedded proposition, the higher its semantic integration is; the higher the semantic integration is, the less likely the embedded clause is to exhibit independent time-reference, full T/A/M-marking or an independent subject. Semantic integration is not binary but defined as a scale. Givón (1980)' *Binding Hierarchy* orders matrix predicates and their complement clauses on a scale of semantic and syntactic integration. Cristofaro (2005)'s *Hierarchy of Complement Clause Deranking*, similar to Noonan (2007)'s and Givón (1980)'s hierarchies, describes a linking between matrix predicate and complement clause form. Cinque (1999)'s *Functional Hierarchy* encodes semantic categories which are mapped in a one-to-one fashion to syntactic structure. Lastly, Wurmbrand & Lohninger (2019) propose a coarse hierarchy of three semantic sorts which are ordered in terms of (in)dependence, transparency, and integration. In contrast to some of the other accounts, the mapping between the semantic hierarchy and morphosyntactic coding of a complement clause is not rigid, but relational.

As mentioned above, when looking at *complementation configurations* (i.e., the combination of matrix verbs and complement clauses), typically three groups can be isolated in the different accounts. Abstracting away from specific definitions, the common insight can be presented as in Table (7).

Table 7: Implicational Hierarchy of Complementation

Most independent Least integrated	*Type 1 > Type 2 > Type 3*	Least independent Most integrated

Properties associated with (in)dependence and integration may differ across languages and frameworks, but the implicational nature can be seen as universal. Once a dependency/integration property is defined, the systems predict that Type 3 configurations can never be more independent and less integrated than Type 2 configurations, which in turn can never be more independent and less integrated than Type 1 configurations. Morphosyntactic properties associate with (in)dependence and integration (such as T/A/M-marking, complementizers, incorporation) align along the hierarchy but are not rigidly mapped to specific categories (although there are cross-linguistic tendencies). This (abstract) hierarchy is, in our view, encouraging—despite the vastly different frameworks and methodologies used to understand complementation, a shared concept has crystallized which can be employed and developed in future approaches.

References

Aissen, Judith & David Perlmutter. 1976. Clause reduction in Spanish. In Henry Thompson et al. (ed.), *Proceedings of the second annual meeting of the Berkeley linguistics society*, vol. 2, 1–30. Berkeley: University of California, Berkeley Linguistic Society.

Aissen, Judith & David Perlmutter. 1983. Clause reduction in Spanish. In David Perlmutter (ed.), 360–403. Chicago: The University of Chicago Press.

Baker, Mark. 2009. Formal generative typology. In Bernd Heine & Heiko Narrog (eds.), *The Oxford handbook of linguistic analysis*, 285–312. Oxford: Oxford University Press.

Baker, Mark C & Jim McCloskey. 2007. On the relationship of typology to theoretical syntax. *Linguistic Typology* 11(1). 285–296.

Bisang, Walter. 2007. Categories that make finiteness: Discreteness from a functional perspective and some of its repercussions. In Irina Nikolaeva (ed.), *Finiteness: Theoretical and empirical foundations*, 115–137. Oxford: Oxford University Press.

Cinque, Guglielmo. 1999. *Adverbs and functional heads: A cross-linguistic perspective*. Oxford University Press on Demand.

Cinque, Guglielmo. 2004. Restructuring and functional structure. *Structures and beyond: The cartography of syntactic structures* 3. 132–191.

Cinque, Guglielmo & Luigi Rizzi. 2010. The cartography of syntactic structures. *Oxford handbook of linguistic analysis*.

Cristofaro, Sonia. 2005. *Subordination*. Oxford University Press on Demand.

Cristofaro, Sonia. 2007. Deconstructing categories: Finiteness in a functional-typological perspective. In Irina Nikolaeva (ed.), *Finiteness: Theoretical and empirical foundations*, 91–114. Oxford: Oxford University Press.

Dixon, Robert MW. 2010. *Basic linguistic theory volume 2: Grammatical topics*. Vol. 2. Oxford University Press on Demand.

Ferreira, Marcelo. 2009. Null subjects and finite control in Brazilian Portuguese. *Minimalist essays on Brazilian Portuguese syntax* 17. 50.

Givón, Talmy. 1980. The binding hierarchy and the typology of complements. *Studies in Language. International Journal sponsored by the Foundation "Foundations of Language"* 4(3). 333–377.

Grohmann, Kleanthes K. 2003. *Prolific domains: On the anti-locality of movement dependencies*. Amsterdam/Philadelphia: John Benjamins Publishing.

Kratzer, Angelika. 2006. Decomposing attitude verbs. Talk given in honour of Anita Mittwoch. *The Hebrew University Jerusalem*.

Landau, Idan. 2000. *Elements of control: Structure and meaning in infinitival constructions*. Dordrecht/Boston/London: Kluwer Academic Publishers.

Landau, Idan. 2004. The scale of finiteness and the calculus of control. *Natural Language & Linguistic Theory* 22(4). 811–877.

Moulton, Keir. 2009a. Clausal complementation and the wager-class. In Anisa Schardl, Martin Walkow & Muhammad Abdurrahman (eds.), *Proceedings of the north eastern linguistics society annual meeting 38*, 165–178. Amherst: University of Massachusetts, GLSA.

Moulton, Keir. 2009b. *Natural selection and the syntax of clausal complementation*. University of Massachusetts, Amherst dissertation.

Nikolaeva, Irina. 2007a. Introduction. In Irina Nikolaeva (ed.), *Finiteness: Theoretical and empirical foundations*, 1–19. Oxford: Oxford University Press.

Nikolaeva, Irina ed. 2007b. *Finiteness: Theoretical and empirical foundations*. Oxford: Oxford University Press.

Noonan, Michael. 2007. Complementation. In Timothy Shopen (ed.), *Language typology and syntactic description*, vol. 2, 52–150. Cambridge, UK: Cambridge University Press.

Nunes, Jairo. 2009. Brazilian Portuguese under minimalist lenses. *Minimalist Essays on Brazilian Portuguese Syntax* 142. 1.

Pesetsky, David. 1992. Zero syntax II: An essay on infinitives. Ms.
Ramchand, Gillian & Peter Svenonius. 2014. Deriving the functional hierarchy. *Language sciences* 46. 152–174.
Rizzi, Luigi. 1976. Ristrutturazione. *Rivista di Grammatica Generativa* 1. 1–54.
Rizzi, Luigi. 1978. A restructuring rule in Italian syntax. In Samuel Jay Keyser (ed.), *Recent transformational studies in European languages*, 113–158. Cambridge, MA: MIT Press.
Rizzi, Luigi. 1997. The fine structure of the left periphery. In Liliane Haegeman (ed.), *Elements of grammar: Handbook of generative syntax*, 281–337. Dordrecht: Kluwer Academic Publishers.
Rochette, Anne. 1988. *Semnantic and syntactic aspects of Romance sentential complementation*. Massachusetts Institute of Technology dissertation.
Rochette, Anne. 1990. On the restructuring classes of verbs in Romance. In Anna Maria Di Sciullo & Anne Rochette (eds.), *Binding in Romance: Essays in Honour of Judith Mca'Nulty*, 96–128. Ottawa, Ontario: Canadian Linguistic Association.
Şener, Serkan, Brain Smith, Kevin Mullin & Suzi Lima. 2011. Cross clausal licensing of accusative case on subjects of CPs in Turkish. *Proceedings of NELS* 39.
Strozer, Judith Reina. 1976. *Clitics in Spanish*. University of California, Los Angeles dissertation.
Strozer, Judith Reina. 1981. An alternative to restructuring in Romance syntax. In *Papers in Romance*, vol. 3, 177–184. Seattle: University of Washington.
Sundaresan, Sandhya. 2012. *Context and (Co) reference in the syntax and its interfaces*. Universitetet i Tromsø/University of Stuttgart dissertation.
Sundaresan, Sandhya. 2018. An alternative model of indexical shift: Variation and selection without context-overwriting. Ms.
Wurmbrand, Susanne, Iva Kovač, Magdalena Lohninger, Caroline Pajančič & Neda Todorović. 2020. Finiteness in South Slavic complement clauses: Evidence for an implicational finiteness universal. *Linguistica*.
Wurmbrand, Susi. 2001. *Infinitives: Restructuring and clause structure*. Berlin/New York: Mouton de Gruyter.
Wurmbrand, Susi. 2004. Two types of restructuring—Lexical vs. functional. *Lingua* 114(8). 991–1014.
Wurmbrand, Susi. 2019. Cross-clausal A-dependencies. In *Proceedings of the fifty-fourth annual meeting of the Chicago Linguistic Society (CLS54)*, vol. 54, 585–604. Chicago: University of Chicago, Chicago Linguistic Society.
Wurmbrand, Susi & Magdalena Lohninger. 2019. An implicational universal in complementation—Theoretical insights and empirical progress. In Jutta M Hart-

mann & Angelika Wöllstein (eds.), *Propositional arguments in cross-linguistic research: Theoretical and empirical issues*. Berlin: Mouton de Gruyter.