Chapter 7

Typology of argument clauses

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This chapter provides an overview of argument clauses, with focus on (declarative) complement clauses. We compare and explore findings from functional typological as well as formal generative approaches, emphasizing that, despite extensive variation (both in analyses and language-specific properties), there are similar restrictions within and across languages: complement clause formation is determined by a combination of i) the semantics of the matrix predicate, ii) the semantics of the complement clause, and iii) the complement's morphosyntactic properties. The conclusion emerging from various typological approaches is that i)-iii) stand in a reciprocal and interactive relationship with each other, determining the possibilities for complement clause formation in natural language. We focus on the observation that, even though complementation strategies are not uniform cross-linguistically, they follow systematic patterns and are arranged along an implicational hierarchy, determined by an interplay of semantics and morphosyntactic complexity. This universal hierarchy becomes evident only from a comparative perspective. The chapter thus contributes not only to a better understanding of form–meaning interactions as well as the systematic nature of argument clauses, but also highlights the importance of typological studies and approaches bridging theoretical differences.

1 Introduction: Universal questions about argument clauses

Following Dixon (2010), argument clauses can be defined along several dimensions: they have the internal structure of a clause (e.g., a configuration involving

Magdalena Lohninger and Susanne Wurmbrand. Typology of argument clauses. To appear in: Benz, Anton, Frey, Werner, Gärtner, Hans-Martin, Krifka, Manfred, Schenner, Mathias & Żygis, Marzena (eds.), Handbook of clausal embedding. Berlin: Language Science Press. [preliminary page numbering]

a predicate–argument configuration; see below for different degrees of clausehood); they function as a core argument (such as subject, object) of another predicate (the matrix or main predicate); they are restricted to a limited set of matrix predicates; and they are, somewhat simplified, instantiations of semantic concepts such as propositions, facts, activities, states, events, or situations (they cannot simply refer to a place, time, entity, object or property). In this chapter we will follow this characterization and summarize major findings on clauses that "fill an argument slot in the structure of another clause" (Dixon 2010: 370). This definition excludes configurations with two verbal predicates in a single clause (a prototypical case would be an auxiliary–lexical verb context), but since the classification of what constitutes a clause (or the distinction between auxiliaries and lexical verbs) is not always clear, we will touch on some of the gray area constructions as well.[1]

The overview focuses on the most typical type of argument clause, namely complement clauses, which we define here as clauses that combine directly with a predicate (verb, adjective, others) as an object.[2] Argument clauses can also occur as subjects (both deep and surface), however the distribution of subject clauses displays a range of language-specific syntactic differences, which make it difficult to state typological claims beyond simple ordering options (such as whether the clause occurs before or after the main predicate). For instance, as suggested in Webelhuth (1992), in the Germanic languages, we find a distinction in finite contexts between complement clauses on the one hand, and subject clauses and topic clauses on the other hand. The former can appear with or without the complementizer *that* (at least in certain contexts), whereas the latter must include the complementizer (when finite). Webelhuth suggests the *External Argument Universal*, which states that "External arguments are nonverbal, i.e., [–V]." (p. 90). A clause with a complementizer is classified as nominal, hence it can occur in subject position, whereas a clause without a complementizer is a verbal embedded root clause, and hence excluded from subject positions. While this covers the Germanic languages well (see adaptations of this approach in, among others, Pesetsky & Torrego 2001), it is not clear whether it can be extended crosslinguistically. In Zulu, for example, finite clauses with a complementizer are clearly nominal (they show agreement marking), and they can occur in topic position,

[1] One set of configurations we will set aside, however, are serial verb constructions. Although some authors (see, e.g., Noonan 2007 below) have suggested complementation configurations for (certain) serial verb constructions, analyses of adjunction and coordination have also been proposed (see Veenstra & Muysken 2017 for an overview), and we are not in a position to settle this debate.

[2] See Vincent (1999) for other definitions of *complement* clause.

but not in subject position (see Halpert 2016, 2019). Infinitives, on the other hand, which do not include a complementizer, are possible in subject position. Halpert suggests language-specific properties regarding the subject position to derive such differences. Since the distribution of subject clauses is dependent on factors such as complementizers, null complementizers, nominal structure, the properties of subject positions, whether a clause counts as nominal or verbal, and other properties, many of which do not have clear theory-neutral definitions, typological surveys have so far been limited to questions about the linearization options of subject clauses and the question of how languages syntacticize argument relations (see Dixon 1995, 2006, Schmidtke-Bode 2014).[3] However, although these works provide extensive usage-based observations about the distribution of argument clauses, they do not include classifications of subject clause patterns, which is the goal of this overview chapter. We therefore have to set non-complement clauses aside in this overview.

When looking at complement clauses typologically, one striking characteristic is that, despite extensive variation, there are similar restrictions within and across languages, which are determined by a combination of the semantics of the matrix predicate, the semantics of the complement clause, and 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 usually not free. However, these restrictions are not completely uniform. Crosslinguistically, 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 matrix predicate? Does each matrix predicate have a unique morphosyntactic type of complement clause it can combine with? 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 typological works on complementation (such as the ones summarized in this chapter) as well as corpus studies (e.g., Stiebels 2018) is that the three factors (semantics of the matrix predicate, semantics of the complement, and morphosyntax of the complement clause) stand in a 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.

[3]Some of these issues are discussed in Chapters 2 and 9 of this volume

In this chapter, we summarize a selection of approaches to complementation which all present broadly applicable, typologically relevant classifications of complement clause patterns. 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 morphosyntax 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. While surface properties (specific morphological coding such as finiteness or word order) vary across languages, it has nevertheless been observed (in the works we will present here, and beyond) that implicational regularities hold. To give a simple example, Hawkins (1999) notes the hierarchy *clauses in a complex NP >> finite clauses >> infinitives*, and suggests the implicational universal that if a language allows a gap (e.g., extraction) in a higher category of this hierarchy, it also allows it in all lower categories. Following the works we summarize, we suggest that both the semantic classification of complement clauses and options for morphosyntactic realizations within complement clauses are ranked according to separate hierarchies. We hypothesize that the semantic complementation hierarchy is universal, whereas the categories of the morphosyntactic hierarchy, but not their order with respect to each other, vary across languages. Similarly, the mapping between the semantic and morphosyntactic hierarchies is not fixed – restrictions in the interaction of the two hierarchies only arise via the implicational relations predicted by the two hierarchies.

Since the form, meaning, and use of argument clauses raises important questions in a variety of linguistic subfields, the topic has attracted significant attention in all frameworks (see also Vincent 1999). Major general studies of complementation include Rosenbaum (1967) (Transformational Grammar), Bresnan (1982) (LFG), Davies & Rosen (1988) (RG), Pollard & Sag (1994) (HPSG), Van Valin (1984, 2005, 2007) (Role and Reference Grammar), Hengeveld (1989), Dik & Hengeveld (1991) (Functional Grammar), Schmidtke-Bode (2014) (Usage-based linguistics), or Kehayov & Boye (2016) (Functional–typological semantics). Pro-

viding an overview of all works and frameworks is impossible, and we concentrate on a subset of the rich literature. In particular, we have singled out typological works which provide classifications of complementation patterns and whose main aim is to characterize form–meaning interactions in complementation.

With this goal in mind, the chapter concentrates mostly on declarative complement clauses for which the typological research is most developed, notwithstanding that embedded questions are also relevant for the classification of complement clauses. One of the central questions addressed in the literature is why certain verbs (such as *know*) can combine with declarative and interrogative clauses, others can only occur with one clause type (e.g., *believe* does not allow an interrogative, whereas *wonder* does not allow a declarative complement), and yet others can even occur with a surface nominal, yielding a concealed question (as in *to ask the time*). Furthermore, a very rich field of syntactic research is the dependency found in questions – what is the nature of the dependency (movement, binding, other mechanism), where do question elements occur (in-situ, the left periphery, a focus position), what is the domain and locality of the dependency, etc. In terms of form–meaning interactions, however, embedded interrogatives show less variation than declaratives. In many languages, embedded interrogatives require the presence of a left peripheral operator domain that can host question expressions, leading to fewer mapping distinctions among different semantic types of interrogative clauses. Indeed, a common view since Grimshaw (1979) is that there is a *canonical structure realization* rule which maps interrogative semantics to an operator domain (e.g., a CP). As a result, the form–meaning interactions are more rigid in questions, which is also reflected in the sparser availability of typological surveys of embedded questions. The compositional semantics of embedding, which also covers questions, is discussed in detail in Chapter 15 of this volume, and we refer the reader to this work for further details.

Lastly, although it has traditionally been assumed that imperative complement clauses are impossible, this conclusion has been challenged in the last two decades by observing more and more languages that allow embedded imperatives (see Aikhenvald 2010, Kaufmann 2012, Kaufmann & Poschmann 2013). Among the languages are German (Kaufmann 2012, Kaufmann & Poschmann 2013), Slovenian (Dvořák 2005), Korean (Portner 2005), English (Crnič & Trinh 2011), and several others. While the list of languages is clearly growing, it is still relatively small and typological research is yet developing.

In what follows, we lay out the main observations and conclusions of Givón (1980), Cristofaro (2005), Noonan (2007), Dixon (2010), cartographic approaches, and our own approach in Wurmbrand & Lohninger (2019). In the last section, we provide a short discussion of the observed differences and variation, as well as

the emerging similarities which point to an abstract notion of universality found in the area of complementation.

2 Approaches to complementation patterns

Although approaches to complementation patterns in natural languages are set in very diverse frameworks (see above), once certain framework-specific terminology and goals are set aside, surprising similarities can be found and formulated. The summaries of the selected approaches presented in this section are intended to highlight this. We start with the richest literature on the topic which, naturally, is provided by functional–typological approaches. Structural–grammatical works are less rich from a language variation perspective, but some systems have been developed with the aim to bridge frameworks and implement typological findings within formal theories. The accounts summarized here differ in focus, scope, and various terminological choices, but a common goal 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 these types of complement clauses are ranked in relation to each other on specific hierarchies. 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.

Before beginning our summaries, we would like to add a word of caution regarding inconsistencies in the terminology, specifically the term *proposition*, which has been applied to a variety of different semantic and/or syntactic contexts and is used differently by different authors. A common use is the distinction between *proposition* and *property/predicate*, which highlights whether a configuration is saturated or includes an open argument slot, respectively. This distinction plays an important role in many works on non-finite clauses, where different types of infinitival complements have been distinguished along those lines (see, among others, Chierchia 1984, Landau 2015 where this issue is discussed centrally). Most of the works we summarize in this chapter use the term *proposition* as a semantic classification for configurations involving attitude contexts (most typically with verbs like *believe, think*), distinguishing *propositions* (or *propositional attitudes*) from other semantic classes such as *desideratives, implicatives*, and others. However, within these approaches, we also find variation regarding which subcategories are included under the broad term *proposition*, whether *propositions* include speech act information, and which structural part

of a clause is associated with this notion. Although this multitude of uses of the same term is unfortunate, the descriptions are usually clear and we do not wish to impose a unified terminology here. Instead we copy the terms as given in the sources we summarize and will only point to certain differences regarding the use of *proposition* in cases where the inconsistencies may lead to confusion or give the impression that certain accounts are not compatible (when in fact they are).

2.1 Givón (1980)

Givón (1980) proposes a functional-typological approach to complement clauses. The main observation is that there is a universal semantic hierarchy 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* which consists of two parts aligned with each other. Matrix predicates are grouped and ordered based on their semantics, which is given as the top branching arrow in the diagram below – the *Binding Scale*. The arrow on the bottom is the *Syntactic Coding Scale* which describes the (in)dependence of a complement clause and thereby its degree of "clausehood." Both scales also express different degrees of (semantic or morphosyntactic) integration of the complement clause into the matrix clause. 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, involving complements resembling independent clauses – the lower (further to the left) a complement clause is on the *Binding Hierarchy*, the more independent and similar to a main clause it becomes.

The semantic dimension of the *Binding Scale* orders matrix predicates along a semantic scale, defined over the functional concepts *binding*, *independence*, and *success* (see (1); Givón 1980: 335, slightly modified). For instance, *to force someone to do something* exerts a stronger influence on the forcee (the embedded agent is less independent) than *to ask someone to do something* does on the person asked. As a result, the predicate *force* is higher (further to the right) on the *Binding Scale* than *ask*, and the action that the complement describes is more likely to succeed.

(1) a. *Binding:* The stronger the influence exerted over the agent of the complement clause by the agent of the main-clause verb, by whatever means, the higher the main-clause verb is on the binding scale.

b. *Independence:* The higher a verb is on the binding scale, the less the agent of its complement clause is capable of acting independently.

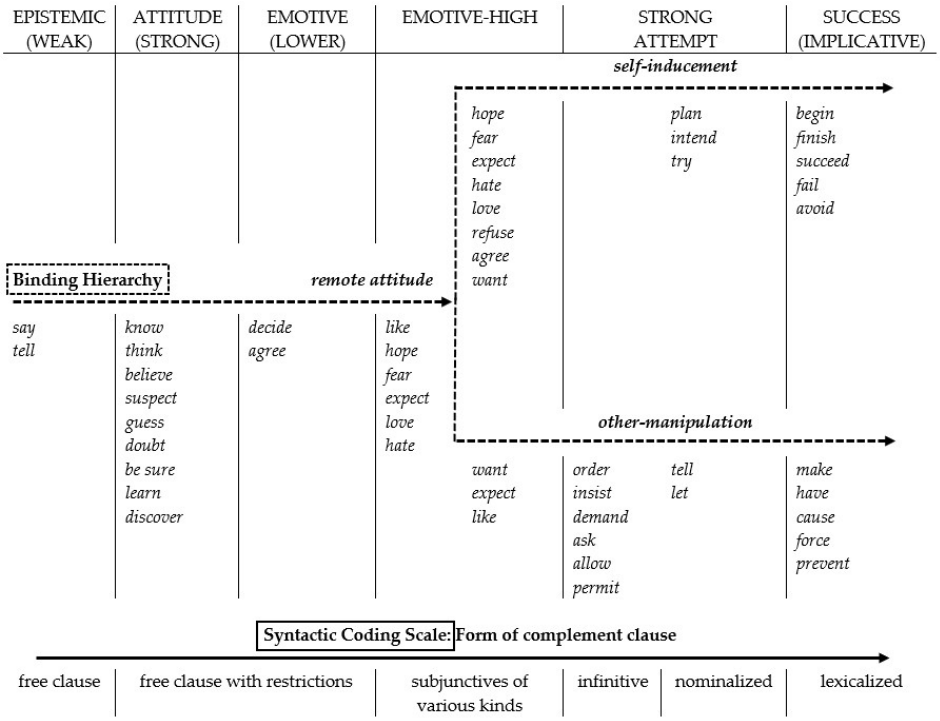


Figure 1: The *Binding Hierarchy* (Givón 1980: 369)

c. *Success:* The less independence possessed by the embedded-clause agent, and the higher the main-clause verb on the binding scale, the more the intended manipulation is likely to succeed.

The scale thus ranges from very strong binding predicates on the right to very weak binding ones on the 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, ...)* >> epistemic verbs *(say, tell).*

The syntactic dimension of the *Binding Hierarchy* is defined as the *Syntactic Coding Scale* (see the diagram above) and applies as in (2) (Givón 1980: 337, (11)).

(2) *Syntactic Coding Scale:* The higher a verb is on the binding scale, the less its complement would tend to be syntactically coded as an independent/main clause.

The properties used to describe independent clauses are: i) the degree to which the complement clause agent resembles a main clause agent (how much it reflects the agent-marking of a main clause); ii) the degree to which the tense–aspect–modality (T/A/M) system of the complement clause is reduced; and iii) 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 together 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 do not exhibit predicate raising. A complement clause is the least independent if it does not allow an independent agent, has no or only minimal T/A/M marking and its predicate can be (depending on the language) raised. Since the *Binding Hierarchy* is scalar and not binary, these two options describe the ends of the scale with various possibilities in between (from most independent to most dependent): free clause >> free clause with restrictions of different kinds >> subjunctive >> infinitive >> nominalization >> lexicalized clause.

Aligning the *Syntactic Coding Scale* with the semantic *Binding Scale*, the *Binding Hierarchy* emerges. If the complement of a predicate at a particular point on the semantic scale is obligatorily coded by a certain syntactic device (e.g., subjunctive, infinitive), then a complement of a predicate higher on the hierarchy (further to the right) cannot be coded by a syntactically lower device. We illustrate this with examples from Bemba (Bantu). Bemba allows the high emotive predicate *hope* to combine with a subjunctive complement as in (3a), but the lower attitude complement *know/believe* only with a more independent *that*-clause (allowing future tense marking) and not with a subjunctive (see (3b) vs. (3c)). Lastly, the lowest verb on the scale, *say*, is only permitted with a complex *that*-complement clause, exhibiting independent (past) tense as in (3d).

(3) Bemba (Givón 1980: 354–366)

a. n-dee-subila umukashi a-inga-isa.
I-PROG-hope woman she-SUBJUNCT-come
'I hope that the woman will/may come.' *High on hierarchy*

b. n-dee-sumina uku-ti a-ka-isa.
I-PROG-think/believe that she-FUT-come
'I think/believe that she'll come.' *Middle of hierarchy*

c. *n-dee-sumina (nga) a-inga-isa.
I-PROG-believe (SUB) she-SUBJUNCT-come.
Int.: 'I think/believe that she'll come.' *Middle of hierarchy*

d. a-a-ebele uku-ti umunaa-ndi a-a-ishile.
he-PAST-say that friend-my he-PAST-come
'He said that my friend had arrived.' *Low on hierarchy*

Thus, there is an implicational correspondence between the semantics of the matrix predicate and the syntax of the complement clause, based on the point of the scale where the predicate and its surrounding elements on the scale are. The points on the scale are not entirely discrete but form a gradual increase of binding (i.e., independence) from left to right. Lastly, it is important to note that the matrix predicates are ordered based on their semantic properties, not just their form. The system predicts that predicates that can be interpreted in more than one way occur in different categories on the hierarchy, depending on the intended interpretation. This is, for example, the case for the Bemba predicate *force/order* which has an implicative reading when combined with an infinitival (dependent) complement as in (4a), but a non-implicative reading when its complement clause is finite (independent) as in (4b).

(4) Bemba (Givón 1980: 347)

a. n-a-koonkomeshya Robert uku-boomba.
I-PAST-force/order Robert INF-work
'I forced Robert to work.' *Implicative*

b. n-a-koonkomeshya Robert (uku-ti) a-boomb-e.
I-PAST-force/order Robert (that) he-work-SUBJUNCT
'I ordered Robert to work.' *Non-implicative*

The interaction between the semantic binding and the morphosyntactic coding scales can thus be described as bidirectional – only if the restrictions of both hierarchies are met and match does a well-formed output arise.

In sum, although the semantic binding and the morphosyntactic coding scales are defined by different notions (in Givón's system even from different components of grammar – function vs. structure), they nevertheless interact and form one general complementation system, the universal *Binding Hierarchy*. A comprehensive picture of complementation can only be depicted when both components are considered.

2.2 Noonan (2007)

The functional complementation classification proposed in Noonan (2007) ties together complement clause size and meaning with the semantics of the ma-

trix predicates and their combinatorial possibilities. According to Noonan's 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, nominalizations and *that*-clauses:

(5) Irish (Noonan 2007: 54, 116)

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

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

c. D'iarr mé air gan imeacht
asked I on him NEG leave.NMLZ
'I asked him not to leave.' (Nominalization)

According to Noonan, languages may exhibit 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 morphosyntactically resemble a main clause and their lexical predicate has the same relation to its arguments as a main predicate would have in a 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 often comes, similar to indicatives, with a complementizer. Only languages with tense and aspect morphology tend to make the indicative–subjunctive distinction, others usually do not exhibit a subjunctive form. Another s-like complementation strategy is parataxis or verb serialization. These constructions typically consist of a subject NP, 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, making them s-like.[4]

Non-s-like complement clauses, in contrast to s-like ones, do not behave like main clauses. The difference between them usually lies in the morphology of the complement predicate – e.g., infinitive instead of indicative or subjunctive. Infinitives, as opposed to indicatives or subjunctives, 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 like 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 modifies a noun.[5]

Certain syntactic processes in complementation can render the complement clause morphology less s-like. Such operations include equi-deletion (aka control), argument raising (subject raising, raising to object, exceptional case marking), incorporation of reduced complements into the matrix clause (clause union, restructuring), 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.

Since the last property is essential for Noonan's classification, we discuss it in more detail here. Complement clauses differ regarding tense marking and time-reference. Tense can either be restricted or non-restricted. Noonan (2007) refers to complement clauses with unrestricted tense as having "independent time reference" (ITR). ITR is the ability to refer to a point in time independent of the utterance time and main clause tense, and to display other tense values than the main clause. 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 event. In DTR contexts,

[4]Note that it is controversial whether verb serialization is an instance of complementation (see Veenstra & Muysken 2017 for an overview). While Noonan (2007) includes it in his typology of complementation, Dixon (2010), for instance, does not. Similarly, Haspelmath (2016) specifically defines serialization as not involving a complementation relation. Furthermore, as pointed out by a reviewer, some of the cases treated as paratactic complementation by Noonan resemble embedded root clauses which may involve less integration into the matrix clause than typical complement clauses (but see Krifka 2023 and Section 2.5 for a short discussion).

[5]As pointed out by a reviewer, such cases may then not qualify as complementation.

tense can either be the same as the matrix tense or be determined by the matrix predicate (e.g., require a particular tense value, such as future morphology), which 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 syntactic operations are enabled by certain semantic values of the matrix predicate. Noonan (2007) characterizes this connection as "the stronger the semantic bond [Givón's *binding*] 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 and its allowance of operations like equi-deletion or predicate-raising. S-like complements have the lowest degree of syntactic integration, non-s-like complement clauses the highest.

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. In Noonan's classification, 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 dependent clause. The semantics of assertion is reflected in different syntactic properties: the predicate inside a paratactic complement can be inflected for subject agreement, whereas a subordinated, infinitive predicate cannot, and paratactic complements may occur with a complementizer whereas subordinated complements often are not able to do so.

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 dependency. Subjunctive complement clauses have determined time-reference (DTR, simultaneous or 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. Noonan (2007) states that if a complement clause has neither indicative nor subjunctive form, it is reduced. One syntactic manifestation of reduction is infinitives, which can only be used when no loss of information arises. Whether an infinitive is licensed depends on the matrix predicate – some contain enough information (*believe, remember, promise,...*) to allow a reduced complement whereas others do not (*regret, know, imagine,...*).

Note that this discussion on the distribution of infinitives and their connection to (loss of) information is of functional nature (see Bianchi 2003, Adger 2007, Bisang 2007, Cristofaro 2007 for other approaches to finiteness).

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 (see Table 1) 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.

Although 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 2.

According to Noonan (2007), all languages have the same general set of matrix predicate options combining with the same set of clausal denotations. 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. The majority of 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 other 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 as well. 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 extremes there is space for other forms with different degrees of semantic and syntactic integration and dependence.

Table 1: Semantic types in Noonan (2007)

Class	Predicates	Specifics
Utterance	*say, tell, report*	simple transfer of information
Propositional attitude	*believe, think, assume, deny*	attitude towards the complement proposition
Pretence	*imagine, pretend, trick into*	world described in the complement proposition does not correspond to the real world
Commentative	*regret, be sorry, be sad*	comments on the complement clause proposition in the form of an emotional reaction, evaluation or judgement
Semifactives	*know, discover, realize, forget*; indirect perception verbs	complement proposition is presupposed to be true
Predicates of fearing	*be afraid, worry, be anxious*	express an attitude towards the complement proposition
Desiderative	*wish, want, desire, hope*	desire that the complement proposition is realized
Manipulative	*cause, force, make, tell, order, command*	express the matrix agent's attempt to manipulate the affectee to do something
Modal perception	epistemic & deontic *can, ought, should*	typically render clause union
Implicatives	*manage, dare, remember, try, forget*	refer to the realization or lack of achievement in the complement proposition
Phasal	*begin, start, continue, stop, finish*	describe the 'phase' (for example the beginning) of an eventuality
Immediate perception	*see, hear, watch, imagine*	matrix agent directly perceives the event of the complement clause
Conjunctive	*'and (then)'*	realized as a verb in some languages (e.g., Lango)

Table 2: Complement clause types in Noonan (2007)

Complement type	Time reference	Matrix predicate
S-like[a]	ITR	utterance, propositional attitude, pretence, commentative
Reduced[b]	DTR	manipulative, modal, achievement, phasal, immediate perception
Both s-like and reduced	ITR/DTR	knowledge, fearing, desiderative

[a] indicative/subjunctive
[b] infinitive, converb, nominalization

2.3 Cristofaro (2005)

Cristofaro (2005) proposes a functional classification tool for complement clauses, based on the claim that the semantics of the main predicate determines how the embedded predicate is semantically and syntactically shaped. The typology is couched in a *Functional Grammar* approach Van Valin (1984, 2005, 2007), Dik (1989, 1997), Hengeveld (1989, 1990), Siewierska (1991). The classification of matrix predicates in Cristofaro's framework is a compressed version of Noonan's classes (modal, phasal, desiderative, manipulative, perception, knowledge 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 (following Van Valin 1984, 2005, 2007 *Role & Reference Grammar*), a clause consists of four layers which are built on top of 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* (predicates designate properties/relations, terms designate entities). The denotata of terms can be placed in space and time and are evaluated in terms of their reality. The second layer involves predication over the terms of layer one and characterizes an event (or *state of affairs*),[6] which can be evaluated in terms of its existence. The third layer involves propositions

[6] Functional-typological works often refer to events, states or situations as *state of affairs* (see also Siewierska 1991, Dik 1989, 1997). Since the difference does not appear to be essential, we use the term *event* here to not introduce another layer of terminological differences.

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. How these four layers interact can be seen in (6) (Siewierska 1991: 40).

(6) In case you haven't heard, Marilyn allegedly gave the letter to Rob surreptitiously during the staff meeting.

The lowest level of (6) is the predicate *give* and the terms it requires (*Marilyn, letter, Rob*). The second layer is the predication over *give* and its terms – it is located in time by past tense marking and in space by the satellite (or adjunct) *during the staff meeting*. The third layer is expressed by the quotative addition *allegedly*, making the predication a proposition, indicating that the speaker came to the propositional content indirectly. The fourth layer describes the clause as a whole and is expressed by *in case you haven't heard* and relates the felicity of the speech act to the state of the hearer's knowledge (Cristofaro 2005: 110).

Complement-taking predicates 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.

Table 3: 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 by the matrix predicate is observable in complement clauses regarding the semantic features time-reference, other T/A/M-specifications, and embedded participants (note that these are statistical tendencies rather than universals):

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, modals and desideratives, the complement time-reference is predetermined.[7]

Aspect: Proposition-level predicates allow any aspect values in their embedded complement clauses, whereas predication-level predicates and phasal predicates require a specific aspect value (e.g., the requirement of the complement clause to exhibit an on-going event). For complement clauses to predicate/term-level predicates, the embedded aspect value is irrelevant for the complementation relation; however, it is usually 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 as it is also irrelevant whether the event expressed by the embedded clause even took place (see Meinunger's (2017) notion of *contra-factivity*).

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 (semantically integrated) to a certain degree, which varies depending on the type of complement. 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 means that the more integrated the content of a complement clause is into the main clause, the more the two events are part of a single event-frame. If the main and embedded clause describe a single event, they tend to overlap spatio-temporally. Utterance predicates, for example, show almost no semantic integration with their embedded clause, perception predicates show integration to some degree, and manipulative predicates show

[7] Note that the tense determination presented in Cristofaro (2005) is not completely identical to the one in Noonan (2007). This might be due to a different selection of languages or a different classification of certain observations. We have to leave this open here.

a very high degree of integration. The most basic diagnostic 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 and tense values, and thus, semantic integration is given to a certain degree. Predetermination (of referents and time/place) is therefore a reflex of semantic integration (and not the other way around). Cristofaro (2005) proposes that semantic integration is not a binary feature but a scale – it forms the *Semantic Integration Hierarchy* in (7) (note that, since knowledge, propositional attitude and utterance predicates show no semantic integration at all, they are not part of the hierarchy).

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

Combining predetermination and semantic integration, the typological hierarchy of complement clause deranking arises, as shown in (8) (adapted from Cristofaro 2005: 122). "Deranking" (see also Stassen 1985) describes, on the one hand, the degree to which the complement clause has predetermined values, and, on the other hand, the degree of erosion of boundaries between the matrix event and embedded clause event, labeled 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.

(8) Hierarchy of Complement Clause Deranking:
Phasals/Modals >> 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 on 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. The hierarchy is scalar and not binary in that the crosslinguistic distribution of complement

clauses does not involve two parametric options, but rather a scale which codes decreasing semantic integration and increasing independence of the complement clause.

2.4 Dixon (2010)

Dixon (2010), similar to the three accounts above, provides a classification of complementation which takes into account both the grammatical properties (i.e., the syntax) of complement clauses as well as their semantics. Examining the crosslinguistic variation, patterns of mutual influence between the semantics of the matrix predicate and the form the complement clause are observed, which, according to Dixon, lead to a universal tripartition of complement clause types – *fact*-type, *activity*-type, and *potential*-type (see below).

The main distinctions used to classify the coding of complement clauses are T/A/M marking, the option of peripheral constituents (expressing time or place), the dependence and marking of arguments, and the possibility of constituent movement. Complement clause types vary in the T/A/M specifications on the embedded predicate. Some complement clause types allow T/A/M specifications as rich as those of main clauses, whilst others only permit a reduced set. "In English, for instance, a *that* clause has the full set of T/A/M 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).

(9) a. I imagined [that Mary wrote/has written/had written a book].
b. I imagined [Mary('s) having written a book].

Another distinction is whether complement clauses can include peripheral constituents like time or place references. This option not only varies among different types of complementation within one language, it also shows crosslinguistic variation. For instance, there are languages such as Jarawara, an Arawan language spoken in Brazil, which do not allow peripheral specifications at all in their complement clauses.

Complement clauses also differ regarding whether they require a subject identical to an argument of the matrix clause or allow/require an independent one. Relatedly, marking of the core arguments of a complement clause may be identical to that in a main clause or involve special markers for the embedded subject. For instance, in a number of languages, a complement clause describing an action takes a possessive marked subject, as in English *-ing* clauses (9b).

The above (and other) properties align with certain semantic properties of the complement clause and together form three types of complement clauses. First,

fact-type complement clauses, which typically indicate that some action took place, involve a structure similar to that of main clauses: they display the full range of T/A/M marking and negation; the embedded subject may or may not be identical to the matrix subject; the time reference of a *fact*-type complement clause is independent (it can refer to a time different from the matrix time), and tense and aspect values may differ from the ones in the matrix clause. Typically, but not necessarily, these complement clauses are marked with a complementizer. However, complementizers may also occur with other clause types and thus are not a reliable indication for *fact*-type clauses. Subtypes of the *fact*-class include clauses that indicate a certain fact, clauses that indicate only a possible fact, and interrogative complement clauses.

Second, *activity*-type complement clauses, which refer to an ongoing activity, involve predicates that have structural similarities to a noun phrase but remain clausal. That is, the verb is not fully nominalized but only receives a reduced, noun-like form. However, it keeps its verbal properties and the complement therefore remains a clause. In English, this is reflected as *-ing* marking. The embedded subject may be different from the matrix subject or be coreferent with it, and it can be marked with a possessive marker. Activity-type complements allow less T/A/M-marking than main clauses, but may have different time-reference. However, tense can only be expressed by a lexical marker (like an adverb) due to the reduced form of the verb. A subclass of *activity* complements are participial clauses.

Lastly, *potential*-type complement clauses refer to the potentiality of the embedded subject getting involved in 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, their verb exhibits a special form, usually the infinitive, and they must either have the same time reference as the main clause or refer to a later time (i.e. a future time reference). Some languages require *potential* clauses to have the same subject as the main clause; however, this restriction is not universal.

Regarding language variation, Dixon suggests that in single languages, the three types (*fact*, *activity*, *potential*) are instantiated by two to five different configurations, differing in their syntactic behaviour and size. According to Dixon, the potential to express all three meanings is universal, but languages do not always use three distinct complement clause configurations to express them. Jarawara, for example, has only one configuration (the one typical for *activity* complements in other languages), which also instantiates the other clause types in that it can express all three meanings. Akkadian (Semitic) has one *fact*-type construction and one for both *activity* and *potential* complements. Tariana

(Arawakan) has a *fact*-type and a *potential*-type configuration, whereas *activity* meanings are realized as pure nominalizations. Since each type of complement clauses has subtypes, languages can also have more than three complement clause constructions: White Hmong, for instance, exhibits two *fact* configurations, one *activity*, and two *potential* configurations. Fijian (Austronesian), on the other hand, has three configurations for *fact*-types, one for *potential*-types, and one for *activity*-types. However, there are also languages lacking complement clauses altogether (e.g., Dyirbal, Australian Pama-Nyungan), replacing them with *Complementation Strategies* such as serial constructions, relative clauses or nominalizations.[8]

A further point we want to highlight is that Dixon (2010) also observes that the type and meaning of a complementation configuration is not only determined complement clause internally, but also depends on the semantics of the matrix predicate: not every matrix verb can be combined with every complement clause. Dixon suggests five classes of matrix predicates, listed in Table 4. Some predicates require a unique type of complement, others may occur with different types of

[8]Note that Noonan (2007) classified serial verb constructions as complementation, whereas Dixon (2010) excludes them from complementation and treats them as a complementation replacement strategy. See also Footnote 4.

Table 4: Matrix predicate classes in Dixon (2010)

Predicate type	Examples	Complement clause type
Attention verbs	*see, hear, notice*	Fact, Activity
Verbs of thinking	*think, consider, imagine, dream*	Fact, Activity
	assume, suppose	Fact
	remember, forget	Fact, Activity, Potential
	understand, know, believe, suspect	Fact, Potential
Decision verbs	*decide, resolve, plan, choose*	Fact, Potential
Verbs of liking	*like, love, prefer, regret, favor*	Fact, Activity
Verbs of speaking	*say, inform, tell*	Fact
	report	Fact, Activity
	describe, refer to	Activity
	promise, threaten, order, command, persuade	Potential

complement clauses, resulting in different meanings. This combination-based meaning-shift can be observed in almost every language (see also Givón 1980).

Finally, as we pointed out in the introduction, the line between complement clauses and single clauses with more than one verbal element is not always very sharp, and Dixon (2010) describes this via an additional category of secondary concepts. In natural languages, some concepts are expressed as lexemes (like the verbs above), whereas others are closed-class grammatical elements (like pronouns or syntactic function markers). However, according to Dixon (2010), in addition, there are secondary concepts which are in between those two, which are coded as grammatical forms in one language but as lexemes in another. Verbal elements belonging to this class are, for instance, *can, must, begin, try, want, hope, plan, make, help*, which crosslinguistically 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 and secondary elements is that the latter modify a full predicate whereas the former are full predicates themselves. In examples like (10), the full predicate *write* is modified by the secondary class concept *begin* (thus, under this approach, cases like (10) would, in fact, not involve a complement clause). We will see in the next section that a similar concept is suggested in a cartographic approach.

(10) John began [to write a detective story]. (Dixon 2010: 400)

Dixon's (2010) tripartite classification of complement clauses is summarized in Table 5.

2.5 Cartography

In contrast to functional grammar approaches, for which structural–grammatical reasoning often plays a more subsidiary role, generative approaches are built on structural–grammatical tools and concepts, and to investigate crosslinguistic variation they typically pursue what has been described as *formal generative typology* (Baker 2010, 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*

Table 5: Complement clause types in Dixon (2010)

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

[a]A reviewer pointed out that the labelling as *fact*-type here is unfortunate since not all of the presented matrix verbs combine with (semantically) factive complement clauses. Dixon (2010) aims to resolve this via describing the *fact* class as also involving *possible facts*; however, these then are difficult to distinguish from *potential* meanings.

approaches to complementation is the idea that syntax regulates, in one way or another, the distribution of complement clauses. Differences between control and raising/ECM have been attributed to concepts of Case and/or clause structure (see Pesetsky 1992 for a very rich study on complementation in English, or Landau 2000 on control crosslinguistically). In the last two subsections, we summarize two 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.

We begin with a brief outline of the concept of cartography and more details on its applicability to complementation in the next section.[9] Cartographic

[9]Cartography was originally not applied to complementation, but rather developed as a model of clause structure (and in its initial form mostly of the left periphery). It then extended to a subclass of complementation, namely restructuring. One aim of this and the next section is to show that cartography and complementation are nevertheless closely connected and that the tools of cartography offer a way to implement the typological patterns. Cartography also

approaches aim to capture universal ordering regularities by representing semantic categories via syntactic structure. Sentences are assumed to involve a fine-grained hierarchical structure of functional projections, which are defined syntactically or semantically, and the resulting *functional hierarchy* is hypothesized to be universal.[10] 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 (either overtly or covertly). The cartography proposed in Cinque (1999, 2004), Cinque & Rizzi (2010) involves a semantic hierarchy of clausal functions such as mood, tense, and aspect (see (11) from Cinque (2004) for the detailed hierarchy), which correspond to functional projections in syntax (we are only concerned here with verbal categories, such as different types of aspect, mood, modality etc., but similar hierarchies have been proposed for the nominal domain). 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 (certain) semantic concepts receive their own syntactic projections (cf. the description of the cartographic enterprise in Cinque & Rizzi (2010: 63) as "an attempt to "syntacticize" as much as possible the interpretive domains"). Although individual 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.

(11) 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 >> Voice >> celerative >> repetitive >> frequentative

The categories can be subsumed into the broader classes Mood >> Modal (epistemic) >> Tense >> Modal (root) >> Aspect, which resemble the hierarchies and

offers, as one of only few frameworks in a generative setting, a way to implement a semantic hierarchy structurally (*Nanosyntax* would be another model, but we are not aware of detailed works on complementation in that framework). Finally, it is noteworthy that the cartographic hierarchy and Givón's binding hierarchy are very similar (despite terminology), and we take such convergence as exciting support for these ideas.

[10] Note that in this section "functional" refers to what is sometimes called the *extended projection* of a head – the part of clause structure that is above the lexical projection of a head (e.g., the functional projection IP, as opposed to the lexical VP).

semantic classifications in the typological approaches discussed so far. One difference is that cartographic approaches yield a rigid one-to-one syntax–semantics mapping. Each semantic category corresponds to its own functional head, resulting in a highly detailed syntactic structure. Cartography thus describes the order and the maximal size of functional clause structure possible in language. Changing the order (unless for scope or information structure purposes) or doubling the occurrence of an element of a particular category of the hierarchy is only possible if a new clause is added (e.g., adding the same adverb twice entails two occurrences of the functional hierarchy, i.e., a bi-clausal structure).[11] 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 even universal. This is best known for adverbials: Cinque (1999) observes that adverb orders show significant similarities crosslinguistically, and suggests that adverbs occupy specifier-positions along the functional hierarchy. The position of different adverbs is thus determined by the meaning, which must match with the categories of the semantic classes along the functional spine.

In Cinque (2004), an extension of the functional hierarchy to some aspects of complementation is provided. Based on the observation that affixes, auxiliaries, functional particles, and certain verbs show consistency in their ordering, it is suggested that not only affixes, but also auxiliaries and certain verbs may occupy positions along the functional spine of a clause. This is visible, for example, in Italian (12), where the sequence *volere* 'want' (volitional) >> *smettere* 'stop' (terminative) follows the hierarchy. If the order corresponds to the hierarchy, a monoclausal structure (i.e., a single lexical verb plus its functional domain) is possible, as confirmed by the possibility of the clause-bound phenomenon of clitic climbing in (12a). If the order does not correspond to the hierarchy, as in (12b), only a bi-clausal structure would be possible, which then does not allow clitic climbing.

(12) Italian (Cinque 2006: 19)

a. Non vi **vuole** **smettere** di importunare.
not 2PL.ACC want.3SG stop.INF to bother
'He doesn't want to stop bothering you.'

[11] Note, however, that certain categories (e.g., *repetitive*) are listed twice in the Cinque hierarchy, which diverges from the strict one-to-one syntax–semantics mapping and may allow some doubling.

b. Non vi **smette** di **voler** importunare.
not 2PL.ACC stop.3SG to want.INF bother
'He doesn't stop wanting to bother you.'

The functional hierarchy in Cinque (1999, 2004) thus covers only a small aspect of complementation, namely cases that relate to clause union or restructuring (Rizzi 1976, 1978; see Wurmbrand 2001 for an overview and references), by effectively treating the lower predicate *not* as a verbal complement clause, but rather as the main (and only) lexical predicate of a single clause, and any other higher verbal elements as functional elements of the same clause. Although there is no valid definition of what counts as lexical vs. functional, and the assumption of verbs like *try, begin* as functional heads is controversial (see Wurmbrand 2001, 2004), it is noteworthy that the Cinque hierarchy in (11) shows surprising similarities to the *Binding Hierarchy* in Givón (1980), which suggests a deeper connection and possible extension to complementation more broadly. Both hierarchies are defined by semantic categories, and although with a different level of detail, the hierarchical order of the categories is the same in both approaches. For instance, both locate speech act predicates (*say, tell, ...*) very high and ascribe them a high degree of independence. These are then followed by a set of epistemic, attitude, emotive, irrealis predicates (*know, decide, hope, ...*). Lastly, both types of hierarchies locate predicates like *plan, begin*, and *try* low, involving the highest likelihood to lead to dependent complement clauses. Setting aside the specific technical implementation proposed in Cinque (1999, 2004) that (certain) higher verbs are functional elements, the cartographic hierarchy nevertheless appears to be doing some important work, and what is needed is a mechanism that links the height of an element on the hierarchy to different degrees of transparency and dependency between the matrix and embedded predicates. Before turning to such a model, certain other issues of cartography need to be addressed.

While certain aspects of cartography are widely accepted in structural approaches (e.g., that CP-level categories occur above TP-level categories), the universality, applicability, evolvability, and innate nature of cartographic hierarchies have also been questioned. Ramchand & Svenonius (2014), for instance, 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 consider predetermined templatic structures as impossible. The concerns are how such a complex system could have evolved, be acquired, and be implemented genetically. Ramchand and Svenonius conclude that there is an irreducible part of clause structure that 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 broad functional domains is semantically necessitated (to yield certain interpretations) and reflects a syntactic residue of cartographic structure. However, since it can be motivated by the conceptual–intentional interface, it is 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. Since the Ramchand and Svenonius clause structure model allows for a direct application to complementation, we lay out their model here first, before returning to the structures of clausal embedding.

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. The three broad domains are hypothesized to be universal; however, in contrast to (full) cartographic approaches, within these domains, there could be language-specific, individual ordering.[12] This is observable, for example, in the flexible ordering of perfect and root modals in many languages, such as the Norwegian examples in (13), in contrast to English, where these categories are rigidly ordered.

(13) Norwegian (Ramchand & Svenonius 2014: 160)

a. Kari kan ha gått på ski.
Kari can have gone on ski
'Kari might have gone skiing.' (*Mod >> Perf*)

b. Kari har kunnet gå på ski til jobb hver dag.
Kari has could.PTCPL go on ski to work every day
'Kari has been able to ski to work every day.' (*Perf >> Mod*)

Hierarchy effects do arise, however, in Norwegian (as in all other languages we are aware of) between epistemic modals and root modals – epistemic modals are always higher than root modals. In a domain approach, this is captured by the hypothesis that epistemic modals, on the one hand, and root modals and perfect,

[12]The resulting clausal organization is very similar to the three "prolific" domains developed in Grohmann (2003) – theta-domain, phi-domain, and operator-domain, as well as the categoric–structural accounts in Platzack (2000), Wiltschko (2014).

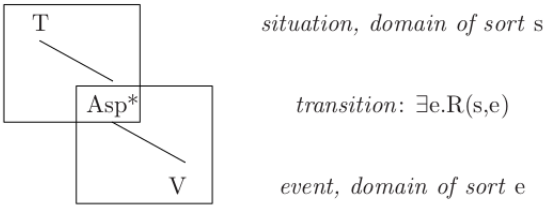
on the other hand, occur in different domains: the former in the propositional domain, the latter in the situation domain. As such, epistemic and root modals are rigidly ordered, whereas root modals and perfect can alternate (at least in principle – different languages may impose additional restrictions).

The three domains are connected to each other via containment such that higher domains contain and are elaborations of lower domains: *p* is built from *s*, and *s* is built from *e*. *Events* correspond to the syntactic argument structure domain (e.g, VoiceP, *v*P, VP). Within the *event*-denoting constituent, 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 they have no temporal dimension (see (14) (Ramchand & Svenonius 2014: 162)).

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

Situations correspond to the syntactic IP/TP-domain (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 *event*, thus presupposes the existence of an *event*, and is necessarily more complex than an *event*. In order to build a *situation*, an *event* has to be existentially closed (or bound by another operator) and transferred to the next domain. The transfer point is a functional head, e.g., Asp*, which combines with an *event*, existentially closes it, and renders a *situation* with an aspectual parameter. Asp*P may then be further combined with a modal or temporal head, which adds further T/A/M parameters and fully converts an *event* into a *situation*. This is shown schematically in (15) (for the detailed computation the reader is referred to the original paper).

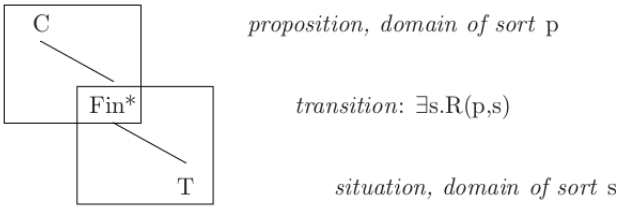
(15) Ramchand & Svenonius (2014: 164)



Lastly, *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 elaboration of a *situation*, presupposing its existence. As shown in (16), the transfer point between a *situation* and a *proposition* is given as Fin* (but nothing hinges on this particular label), which adds temporal and world parameters to a *situation*, including speaker-oriented variables or pronouns, thereby anchoring the *situation* in the discourse.

(16) Ramchand & Svenonius (2014: 164)



Thus, 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.

A significant benefit of this model is that the broad containment relations are not stipulated but follow from the semantic composition of *events, situations*, and *propositions* (see also Ernst 2001 for similar building blocks deriving adverbial hierarchies). The most important insight lies in the way syntax and semantics interact. Although there is a tight connection between the broad syntactic domains and the resulting semantic sorts, there is no general one-to-one mapping between syntax and semantics. The broad domains are uniform (e.g., to create a configuration that is interpreted as a *situation*, some layer of the T/A/M-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. It imposes fewer universal restrictions than Cinque's fine-grained hierarchy, which is warranted by the crosslinguistic variation found.

At this point it is useful to come back to the notion of *proposition*. In the Ramchand and Svenonius model, the term *proposition* refers to a combination of syntactic and semantic properties – a full clause that is anchored to the context. However, they do not discuss details of the domain that turns a *situation* into a *proposition*. Traditionally, the CP-domain included projections for clause typing and force (interrogative, declarative), information structure (topic and focus),

and in cartography also finiteness. Another trend has been to enrich the propositional domain to also include representations of the speaker and the addressee, information about speech acts and illocutionary force (see, among others, Speas & Tenny 2003, Wiltschko 2014, 2017, Krifka 2023, Miyagawa 2022, and Chapters 2 and 16 of this volume).

In these contexts, the notion of *proposition* becomes even more complex and it is important to separate terminological differences from content differences. Whereas *proposition* refers to the entire clausal domain (i.e., the CP-domain) in the Ramchand and Svenonius model (with TPs mapping to *situations*), *proposition* refers to the TP-domain, excluding the illocutionary domain above, in Krifka (2023). In Krifka (2023), following a tradition starting with Stenius (1967), the CP-domain of assertive clauses is decomposed into the layers *speech act* [Act] >> *commitment* [Com] >> *judgement* [J], where *judgements* correspond to epistemic and evidential attitudes, *commitments* to social commitments related to assertions, and *speech acts* to updates or changes of the common ground. Note, however, that the two views are fully compatible – the Ramchand and Svenonius model (as well as our model in the next section) can either be extended by including another domain above the CP (a fourth clausal domain to encode speech act and illocutionary force), or by a more structured organization of the CP domain itself including the categories suggested in Krifka's model. We leave the choice of technical implementation open here, but note that a combination appears very promising as both approaches naturally lead to different complementation patterns (see next section). Furthermore, Krifka's structure is also defined via containment. By adding the syntactic head *Judge* to a *proposition* (or in Ramchand and Svenonius's terms *situation*) a propositional function is created specifying that a judge considers the proposition expressed in the clause to be true; by further adding the syntactic head *Commitment*, the JP function is turned into another propositional function specifying that the speaker is committed to the judged proposition. Lastly the syntactic head *Act* includes an operator that determines whether the ComP is a question or assertion. Given these containment relations, the categories suggested by Krifka thus form a syntactic and semantic hierarchy with a predictable order ActP >> ComP >> JP >> TP.[13]

[13] As the reader can verify, these categories are very similar to the highest categories in the Cinque hierarchy in (11) and thus the two approaches are compatible. A main advancement of Krifka's approach is that the structure is defined via containment, thus necessarily built in the way it is, whereas (11) is merely given as a list without motivation. As shown in Krifka (2023), the semantic hierarchy is also supported by syntactic differences, both within simple clauses and different types of *proposition* complements. Furthermore, Wurmbrand (2024) suggests that the hierarchy is reflected in an implicational ECM hierarchy. In this paper we cannot go into details of finer-grained structures of the broad clausal domains, but refer the reader to these works.

Krifka (2023) also provides a new approach to the phenomenon of embedded root clauses, such as embedded *that*-less clauses in English or embedded verb second clauses in German (see Heycock 2017 for an overview). Embedded root clauses have raised interesting questions about the nature of complementation in these cases. On the one hand, embedded root clauses show similar properties to regular embedded clauses (extractability,[14] functions as a semantic argument of the matrix predicate), but on the other hand, they appear to be less integrated into the matrix clause, thus less complement-like (see Reis 1997). This discrepancy is resolved in Krifka's model by representing embedded root clauses as ActPs, since they show properties of illocutionary acts and have the potential to update the common ground of the conversation. True embedded clauses, on the other hand, lack the ActP-layer and thus do not constitute independent speech acts.[15] The existence of embedded root phenomena thus makes it very plausible that embedded clauses include a structural aspect of speech act information, and further typological research will show whether their distribution allows us to gain further insights into the question of whether a syntactic separation of what Ramchand & Svenonius refer to as *proposition* and a distinct speech act domain is supported or whether the layers could be seen as finer-grained structure of the proposition domain.

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

2.6 Wurmbrand & 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

[14] Note that there is a controversy with respect to extractability out of embedded verb second complements (see Reis 1997, Holmberg 1986).

[15] Similarly, embedded direct speech contexts exist (see Chapters 15 and 17 of this volume), but it is not clear yet how wide-spread (with respect to different languages) this phenomenon is. Another phenomenon that is relevant in this context is reported speech, in particular the question of which verbs allow it (see Spronck & Nikitina 2019 for a typology).

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.

Proposition complements comprise speech and epistemic contexts (possibly also factive complements). The truth of the complement clause can be asserted via predications such as *which is true/false* (e.g., *Nova claimed that she bought salad, which is true* can mean that it is true that Nova bought salad) or be presupposed as in the case of factive complements. Furthermore, *proposition* complements are temporally independent in that the embedded event 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 reference time (typically, the attitude holder's "Now") which anchors the embedded tense. Lastly, *proposition* complements may involve speaker-oriented and/or discourse-linking parameters, an independent embedded subject, and, if infinitival, 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 and irrealis contexts, refer to temporally grounded events that are not evaluated for truth (no assertion or predication of their truth is possible), but for other properties (such as likelihood, value to the speaker; for instance, *Nova promised to buy salad* can be followed up (when referring to *to buy salad*) with *...which will never happen/which is a good idea/not easy to do on Sundays*). *Situation* complements elaborate *Events* 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 ('to decide to do something'; 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, infinitival *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*.

Lastly, *event* complements involve implicative and strong attempt contexts. They lack speaker- and utterance-properties, as well as world- and time-properties. They are therefore tenseless – the embedded *event* occurs simultaneously with the matrix event and in contrast to *situation* complements, cannot refer to a time in the future relative to the matrix time (e.g., **She forgot/failed/managed to leave tomorrow*). Furthermore, *event* complements may have reduced argument structure and/or event properties, and typically trigger obligatory exhaustive control. Lexical matrix verbs which take *event* complements are *avoid* (implicative), *begin, continue, fail, finish, forget* (implicative), *manage, 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.

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 7. 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

Table 6: Complement clause types (Wurmbrand & Lohninger 2019: 194)

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)	no speaker/utterance properties; no time and world parameters; tenseless, simultaneous
Infinitives	partial control possible	partial control possible	exhaustive control

Table 7: *Implicational Complementation Hierarchy* (ICH) (Wurmbrand & Lohninger 2019: 188)

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

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.

The three-way distinction is motivated by a range of what Wurmbrand & Lohninger (2019) refer to as *ICH-signature* effects, which can be observed within and across languages. As indicated in the last row of Table 8, for any property [P] that distinguishes between different types of complements, *proposition* and *event* complements show the opposite values, and *situation* complements either allow both values or 'side' with one or the other (depending on the property). ICH-signature effects have been observed for a range of morphosyntactic and semantic properties. An illustration is given in Table 8 for the distribution of clause introducers in Greek and Bulgarian. The two languages lack infinitives and all non-factive declarative 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 reflects the ICH-signature: *proposition* complements obligatorily require *če/oti*, whereas *event* complements only allow *da/na*. *Situation* complements permit both options.

The mapping between the hierarchy and morphosyntactic properties of complement clauses is not absolute but relative. How independence, transparency,

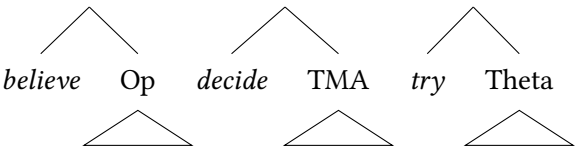
Table 8: Clause introducers in Greek and Bulgarian, ICH-signature (Wurmbrand & Lohninger 2019: 196)

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

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 crosslinguistic 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 in certain languages (see also Boye 2010 making a similar observation with respect to tense). 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.

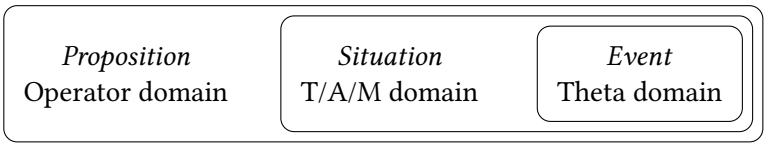
While there is no direct connection between the ICH and morphosyntactic properties, Wurmbrand & Lohninger (2019) propose that there are mapping restrictions between them. Classifying complement clauses in terms of the conceptual primitives and sorts defined in Ramchand & Svenonius (2014) (see the previous 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, illustrated in (17).

(17) (Wurmbrand & Lohninger 2019: 214)



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 (18).

(18) (Wurmbrand & Lohninger 2019: 214)



Proposition, *situation*, and *event* complements may thus differ in structural size (in addition to different semantic complexities).[16] 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 (17). This is for example the case in Dutch *try* complement clauses, which can occur with or without the complementizer *om*, but the alternation does not induce a meaning-change of the configuration (see den Besten & Rutten 1989, Rutten 1991). Thus, in these cases, the *event* clause can be structurally larger than the minimally required Theta/Voice-domain. The ICH model only demands that structures cannot be too small or lacking crucial components to yield the desired output.[17] For instance, to create a configuration that should be 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 operators like tense, modality or aspect. Similarly, in such a case it would also be possible to add a syntactic 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.

[16] Wurmbrand & Lohninger (2019) adopt the terminology in Ramchand & Svenonius (2014); however, as pointed out above, the *proposition* domain may be enriched by speech act categories.

[17] A reviewer pointed out that smaller than required structures could arise if "coercion" does not only affect the meaning of matrix predicates but also complements and that "concealed questions" (Heim 1979) might be a case in point. We leave this open to further research.

The (partial) autonomy approach of syntax is paired with what Wurmbrand & Lohninger (2019) refer to as a *synthesis* condition on complementation. In contrast to cartographic approaches that assume a syntactic template, the ICH-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 2009a,b), 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 lexical entries for these verbs. Instead, these verbs have an underspecified semantics (see White 2014 for a related idea) 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 can also be 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 individual denoted by 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 crosslinguistic distribution of (im)possible class switches and their semantic and morphosyntactic properties.

3 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 crosslinguistically; 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 crosslinguistic patterns. The first part of this section presents points of variation found across languages as well as differences in the theoretical conclusions. In the second part, we show that there are nevertheless also many encouraging similarities which can be extracted from the different approaches.

3.1 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 crosslinguistic tendencies. Natural languages often behave heterogeneously when it comes to clausal complementation, and especially morphosyntactic properties may show language-specific idiosyncrasies and crosslinguistic 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 differ not only 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 absent T/A/M-specifications, yielding three complement clause options. Lastly, Noonan (2007) employs finiteness (although he does not use that specific term) as a defining criterion: fully

specified indicatives or partly specified subjunctives 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 crosslinguistic 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, as illustrated for Bulgarian in (19) where even *event* clauses exhibit full T/A/M-marking. While T/A/M-marking does not necessarily distinguish between different clause types, the existence of ICH-categories, however, can nevertheless be observed by the distribution of clause introducers (see Wurmbrand & Lohninger 2019, Wurmbrand et al. 2020).

(19) Bulgarian (Wurmbrand et al. 2020: 122)
Lea se opitvaše da čete kniga.
Lea REFL try.PRF.3SG DA read.PRS.3SG book
'Lea tried to read a book.'

A related controversy concerns the concept of 'finiteness' itself. Due to the extensive crosslinguistic variation in the distribution of finiteness in complement clauses, 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 2007b). Among the categories that have been suggested to reflect finiteness in different languages are tense, aspect, mood, illocutionary force, person marking, politeness, special forms which cannot be used in independent clauses, and/or nominal morphology on the verb (see the works in Nikolaeva 2007a). Although finiteness often reflects different degrees of clausehood, there is no specific feature or property of finiteness that applies crosslinguistically 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 typologically as there is a significant amount of variation in the distribution of morphosyntactic coding of complement clauses. Languages 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. Although reduced T/A/M-possibilities are a valid, efficient way to distinguish between complement clause

types, 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*. Noonan (2007) suggests that raising and equi-deletion are both instantiations of dependent subjects, which yield non-s-like complement clauses. Whereas infinitives lack a subject, 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 and integration of the embedded clause depends on the independence of its subject. Dixon (2010), too, 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 dependence to clause reduction – if the subject is dependent on an argument of 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 crosslinguistically. While it is common that certain types of complements require an interpretation in which the embedded subject is identical to the matrix subject (or lack a subject even semantically), 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, Givón 1980), but this is not the case universally. Raising to subject or object from a finite (i.e., non-reduced) complement clause, also known as *Hyperraising*, is found in several languages (see Wurmbrand & Lohninger 2019 and Lohninger et al. 2022 for an extensive overview), and examples like (20) from Brazilian Portuguese contradict the claim that subject raising always renders a non-s-like reduced clause.

(20) Brazilian Portuguese (Martins & Nunes 2010: 145)
Os meninos parecem [que viajaram ontem]
the boys seem.3.PL [that traveled.3.PL yesterday]
'The boys seem to have traveled yesterday.'

Lastly, even control/equi-deletion has been shown not to be restricted to infinitives but to be 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, even the mere *definition of clause(hood)* is 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 or a gray area. Givón (1980) and Noonan (2007), for example, include nominalizations into the set of complement clauses, whereas Dixon (2010) does not. Noonan (2007) includes serial verb constructions into his complementation patterns, but Dixon (2010) considers them as different complementation strategies, set aside from complement clauses. Givón (1980) treats clause union and predicate raising as involving a complement clause construction, whereas Noonan (2007), Dixon (2010), and Cinque (2004) analyze the two verbal predicates as constituting a single clause.

The diversity of the definitions of "clause" carry over to notions built on that concept, such as *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, and the "complement" is the main lexical predicate of the clause (i.e., there is only one lexical VP). Such functional restructuring thus creates a monoclausal and monopredicate 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) and Wurmbrand & Lohninger (2019), where it is argued that monoclausality comes in several forms and degrees: functional restructuring, lexical restructuring lacking TP and CP domains, and lexical restructuring lacking only the CP domain.

Furthermore, the works on complementation have brought out that the distinction between "functional" and "lexical" verbal elements is not sufficient, and that between the two there is a class which language-specifically patterns with one or the other side. 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 thematic properties usually reserved to lexical verbs.

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. Some accounts give coarser-grained 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, defined by the predicate's and complement clause's semantics (*proposition, situation, event*), with possible further language-specific subdivisions.

At a more general level, the framework diversity is reflected in the mechanisms and tightness of the *linking between 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. Givón (1980), Cristofaro (2005) or cartographic approaches suggest that certain matrix predicates only combine with complement clauses of a specific morphosyntactic form (or clausal layer), i.e., that the linkage between the two is rather rigid. A looser connection is assumed in Wurmbrand & Lohninger (2019), where it is proposed

that there are minimal matching requirements for the (morpho)syntactic computation of different types of complement clauses, but mismatches are possible as well, making the semantics–morphosyntax mapping relative and not absolute. Crosslinguistically, morphosyntactic properties align along a complementation hierarchy, but not in a rigid one-to-one fashion (see also Cristofaro 2005).

3.2 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.

In this section, we summarize some of the similarities in clausal 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 predicates 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). Remarkably, 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's (2007) 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 crosslinguistic 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.

An interesting phenomenon in this context, which is 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) and summarized under our synthesis approach (see above) is that when a verb has alternating meanings, the morphosyntactic coding of the complement clause tends to correspond to different meanings (as for example with English *tell* which shifts between a speech verb (indicative complement) and a command (infinitival complement).[18]

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.

A second observation that applies crosslinguistically 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

[18] A strict form–meaning mapping is, however, not always the case. There are also predicates like *to be glad* which take different types of complement clauses (finite or non-finite), but do not shift their meaning. This challenges the view that verbs that can occur in two different morphosyntactic frames always come as two lexical entries.

(i) a. I'm glad to be teaching at the university.
b. I'm glad that I'm teaching at the university.

clauses do not combine in an "anything goes" fashion, but there are restrictions, typically definable only implicationally. 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 predetermined 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 that combine only with DTR complements, only with ITR complements, or with either DTR or ITR. Cristofaro (2005) and Dixon (2010) propose that there are three options for embedded time-reference: no determination, future predetermination, and same time as matrix. According to those authors, 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 time-reference), 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 morphosyntactic types of complements.

When looking at complementation configurations, two relevant restrictions emerge across all accounts: i) the matrix predicate and the embedded clause must be semantically compatible, ii) a complement clause needs to be seen in combination with its matrix predicate, and iii) the semantics of the complement clause is linked to its morphosyntax, though not fully necessarily in a one-to-one fashion. As mentioned above, how this linkage is derived differs between functional–typological accounts (where extragrammatical functions motivate structure) and structural–grammatical accounts (where selectional restrictions or synthesis does); however, the core insight, namely that there is a linkage, is similar across frameworks. Abstracting away from specific definitions, but focusing on the similarities, the common insight about complementation configurations crosslinguistically can be presented as in Table 9.

Table 9: 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 a true 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 associated 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 crosslinguistic 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.

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