

Linguistic networks: connecting constructions within and between languages

Linguistic analysis is traditionally stratified into levels: syntax, lexicon, morphology, etc. This practice, however, is not very well suited to handle interaction between the levels, and linguistic patterns that combine properties from different levels tend to be overlooked or receive a one-sided, partial treatment. Accordingly, such structures are also notoriously difficult for second-language (L2) learning, language technology and translation alike (e.g. Sag et al. 2002). For example, the Swedish pseudo-coordination sentence “Hon går och grubblar”, which integrates properties from several linguistic levels (cf. Andersson & Blensén 2018), is literally but incorrectly translated “She goes and ponders” in Google Translate, instead of e.g. “She is worrying”.

In contrast, current approaches such as Construction Grammar (CxG) treat language in toto as a network, where structures are not stratified into different levels, but all linguistic patterns – regardless of level – are described in the same way: as constructions, i.e. conventionalized combinations of form and function. A construction may combine properties from several levels, including complex relations between form and meaning, as in the pseudo-coordination example above. With this approach, we may also capture connections between structurally different constructions in different languages. From this perspective, the Swedish structure “gå och VERB” corresponds functionally to the English pattern “be VERB-ing”.

In CxG, language is viewed as a network of constructions. Taking this idea to applied practice, there are now databases of construction descriptions under development for several languages, including Swedish (Fillmore et al. 2012, Lyngfelt et al. 2018a,b). Such construction databases, descriptive resources aiming to bridge the traditional gap between grammars and dictionaries, are called constructiCons. So far, however, the existing constructiCons are sets of only partially related construction descriptions and not yet comprehensive networks as proposed in CxG theory. They are also primarily monolingual resources.

In this project, we will address both these current limitations in an integrated effort, as we believe they are best tackled in combination. On the one hand, we will add a comprehensive network structure to the existing Swedish ConstructiCon (SweCcn), filling central descriptive gaps and connecting the whole range of various construction entries. On the other hand, we will develop a cross-linguistic linking system to connect constructions in different languages, using comparative tools from language typology (Haspelmath 2010, Croft 2016, *forthc.*). The construction entries in SweCcn will be connected to corresponding language-neutral notions in the linking device, and the integrated network infrastructure is meant to serve as a prototype model that can then be extended to other languages.

Through this model, we add a cross-linguistic dimension to constructiCon development, which in turn facilitates the application of constructiCons in what is called *multilingual*

constructicography (Lyngfelt et al. 2018b, forthc.). To this effect, we collaborate with constructiCon projects for other languages, such as Brazilian Portuguese, German, and Japanese.

Purpose and research questions

The purpose of the project is two-fold: to upgrade the Swedish ConstructiCon (SweCcn) to a comprehensive construction network and to develop a system for connecting constructions in different languages. These two integrated research objectives are complementary to the overall goal of making constructiCon development uniformly and consistently applicable within and across languages.

Through this enterprise we also take on central issues in both constructionist theory and contrastive linguistics. Our guiding research questions are:

- **RQ1:** How can the grammar of a language, Swedish, be fruitfully accounted for as a network of constructions?
- **RQ2:** How can constructions be connected across languages through a linking system of shared features?
- **RQ3:** How can the somewhat conflicting demands of describing a language on its own terms and capturing cross-linguistically relevant properties in language-neutral terms be conciliated in a constructionist approach?

RQ1 connects directly to the proposed upgrade of SweCcn, which will primarily consist of the development of a network structure and an account of the core syntax constructions that constitute central nodes in the network. RQ2 is grounded in the recognition that linguistic categories differ across languages, which makes direct comparison between particular constructions difficult and time-consuming. Instead, we will address cross-linguistic relations between constructions through a flexible linking system based on shared properties. Such properties may be specified in terms of comparative concepts, of the sort employed in language typology, and FrameNet frames (see below). In combination, the language-internal network development and the cross-linguistic linking system will inform RQ3.

Theoretical background and key concepts

With the Swedish ConstructiCon (SweCcn) as a base, the project is built on two legs: the internal network development and the external linking system. Firstly, we present general theoretical notions, and then concepts related to the language-internal network for Swedish. Apart from being a research objective in itself, the language-internal network for Swedish is a prerequisite for the linking model. Secondly, we turn to the linking system that aligns constructiCons across languages.

Language as a network of constructions

One of the fundamental assumptions in Construction Grammar (CxG) and related theories is that a human language is essentially a network of constructions, i.e. conventionalized pairings of form and meaning/function (cf. Fillmore 1988, Diessel 2019). Such a network is usually called a *constructiCon* (following Jurafsky 1991). In applied practice, a constructiCon is a descriptive resource, i.e. a structured collection of construction descriptions (Fillmore 2008, Fillmore et al. 2012, Lyngfelt et al. 2018b). Thus, the term *constructiCon* displays the same kind of polysemy as the related terms *grammar* and *lexicon*: on the one hand a theoretical conception of a cognitive linguistic system, on the other hand a corresponding descriptive resource.

ConstructiCons in constructionist theory

The idea of language as a network of constructions has been a standard assumption in constructionist theory since the 1980s (cf. Fillmore 1988). However, while this idea is clearly a notion about language as a whole, the descriptive coverage to substantiate it has so far been somewhat uneven. Most previous work in CxG consists of case studies of particular constructions, especially those combining lexical and grammatical properties usually taking a usage-based, bottom-up approach (cf. Goldberg 2006). Less attention, however, has been paid to “the entirety” of language (Boogaart, Coleman, & Rutten 2014:1). This, too, needs to be substantiated by empirical work, but so far, comprehensive accounts actually approaching language in its entirety (instead of just implying such an approach) are rare. The few exceptions (e.g. Fillmore & Kay 1993; Sag 2010, 2012) mainly pertain to English and depend on language-particular stipulations not applicable to other languages.

Hence, interrelations between different types of constructions, as well as the core syntax, i.e. general phrasal and clausal syntax, remain understudied from a CxG perspective, especially outside English. This particularly relates to the issue of interrelations between different kinds of constructions:

The grammar of a language can be seen as a repertory of constructions, plus a set of principles which govern the nesting and superimposition of constructions into or upon one another. (Fillmore 1988:37)

In the classic Berkeley CxG model (e.g. Fillmore & Kay 1993), constructions license concrete expressions, which are presumably combined into utterances by unification. This is rather straight-forward when the object slot of a verb phrase is unified with a noun phrase, but combinations can be far more complex than has previously been accounted for. For example, a sentence like “Was it McIlroy who never seemed to be out-driven during tournaments?” instantiates a cleft, a polar interrogative, raising, passive, incorporation, etc., plus lexical constructions (i.e. words), and whatever is needed to get the basic clause formation, argument structure and word order right. Thus all constructions involved have to be defined in such a way that the corresponding descriptions are compatible, and a flexible mechanism for their combination will have to be in place. (There are, however, a few applied approaches addressing

this issue. Two interesting such studies are the Fluid Construction Grammar (e.g. Steels 2011, van Trijp 2017) and the pedagogic initiative called CASA (a Constructionist Approach to Syntactic Analysis; Herbst & Hoffmann 2018).

By developing the Swedish ConstructiCon into a comprehensive construction network, the proposed project has to address all of these issues: the overall network structure, the general syntactic constructions, and the interplay between constructions in combination. The proposed development of SweCcn is therefore a test of central assumptions in CxG and aims to provide proof of concept of the idea of language as a network of constructions.

Descriptive constructiCon resources

Building constructiCon resources means doing construction grammar under the practical conditions of lexicography, i.e. turning construction analyses into brief entries for each construction while weighing detail and precision against user-friendliness. This hybrid field of study has been dubbed *constructicography* (Lyngfelt 2018).

The first pilot constructiCon was designed for English in Berkeley (Fillmore 2008, Fillmore et al. 2012), as a complement to the English FrameNet (see below). It has since inspired similar constructiCon enterprises for Brazilian Portuguese, German, Japanese, Russian and Swedish (see Lyngfelt et al. 2018b). The Swedish ConstructiCon (SweCcn) is an online database intended as a multi-purpose resource for linguistics, language technology and (second) language education (Lyngfelt et al. 2018a). It currently comprises around 400 construction entries and is integrated with the language-technology infrastructure of *Språkbanken Text* at the University of Gothenburg (Borin et al. 2010, 2012).

With the possible exception of Russian, which is structured differently, none of the existing constructiCon resources have so far been developed into a comprehensive network structure. For the most part, they still consist of lists of construction descriptions, the selection of which is partially systematic, partially ad hoc. SweCcn is among the furthest advanced ones so far, as the basics for a constructional network are in place and the entries are sorted into (grammatical) categories and so-called *types*. The types are based on salient properties shared by a group of constructions, regarding form and/or function, the construction as a whole or particular construction elements: contrast, comparison, compound, coordination, reflexive, implicit elements, etc. (Lyngfelt et al. 2018a). Construction entries are assigned to one or (usually) more types and may thereby be grouped according to different features, including combinations of properties. The type system, although still incomplete and preliminary, may serve as a point of departure for future network development, and to some extent for linking SweCcn to comparative concepts (see below).

The key to developing SweCcn into a coherent and comprehensive network is the integration of the core syntax. Firstly, more general core-syntax constructions are the central nodes of the network through which the more specific constructions are connected. Secondly, they serve to regulate the combination of expressions into larger units. Consequently, they are crucial not only to the construction network as such, but also to the design of the combinatory mechanisms.

In summary, what is required for the upgrade of SweCcn corresponds to the remaining issues regarding the theoretical CxG notion of ConstructiCon as a network of constructions. Thus, the proposed development of SweCcn, presented below as WP1, will provide proof of concept of this notion – as well as pinpoint its potential shortcomings.

Multilingual constructicography: connecting constructions across languages

Relating grammatical constructions across languages is more complex than comparing singular words, since more or less corresponding construction entries may differ on many dimensions: some languages employ a question particle to express what others mark by word order and/or prosody, case suffixes in one language correspond to adpositions or word order restrictions in another, etc. This multidimensional aspect of the mapping also makes issues of granularity and categorization more complex. Furthermore, the emerging constructiCons still have limited and only partially corresponding coverage.

Nevertheless, pilot studies comparing English construction entries to Swedish and Brazilian Portuguese, respectively, show promising results, establishing close counterparts to all but a few of the English constructions in both Swedish and Portuguese (Bäckström et al. 2014, Laviola 2015, Lyngfelt et al. 2018c). However, they also find considerable variation regarding the degree of functional equivalence and formal similarity of the mappings, and the comparisons proved far too time-consuming for pairwise mappings between particular constructions to be realistically feasible on a larger scale.

Instead, we propose a cross-linguistic linking system connecting constructions through shared properties. Which properties are relevant may vary between different kinds of constructions as well as different purposes of the user or application (cf. Boas et al. 2019, Lyngfelt et al. 2018c). Hence, an infrastructure for connecting constructions across languages should be flexible enough to be adapted to the relevant situation. For definitions of relevant linking properties, we will make use of two kinds of cross-linguistic resources: *comparative concepts* (Haspelmath 2010, Croft 2016, forthc.) and FrameNet *frames* (Fillmore & Baker 2010, Ruppenhofer et al. 2016).

Comparative concepts

Comparative concepts (CCs; Haspelmath 2010, Croft 2016, forthc.) are theoretical constructs designed by language typologists specifically for the purpose of comparing linguistic structures across languages. CCs consist of linguistically relevant properties such as ‘appositive’, ‘bivalent’, ‘causative’, ‘deictic’, ‘reflexive’, etc. They include semantic and functional notions such as ‘animate’, ‘stative’ and ‘topic’, as well as form-function combinations such as ‘pronoun’, ‘cleft’ and ‘relative clause’. However, in order to facilitate cross-linguistic application and reduce the risk of language bias, CCs are defined in language-neutral terms, abstracting away from language-particular characteristics of associated constructions in different languages, such as Portuguese pronouns or Swedish relative clauses.

For our linking model, we will use the set of CCs presented in Croft (forthc.). Croft provides an extensive list of CCs as employed in modern language typology, explicitly defined in relation to a constructionist view of language. Hence, they should be well suited for multilingual constructicography.

As a first exploration of CCs as a linking device, a pilot study (Lelie 2019) investigates how Croft's CCs can be compared and, if possible, connected to construction entries in SweCcn. Specifically, Lelie compares CCs to the types and categories of constructions in SweCcn (see above), as these are defined in terms of general properties shared by groups of constructions; in that regard they are conceptually similar to CCs, except for being language specific. Lelie finds that most of the Swedish types and categories match Croft's CCs fairly well. Non-matches are mostly due to lack of coverage in the source material, and only a few partial mismatches are explained by particular properties of Swedish constructions. In general, the results from Lelie's (2019) pilot study are promising.

Frames and framenets

Frames are semantic units based on the idea that words are not understood in isolation but in relation to the scenarios – called *frames* – they refer to, and also in relation to other participants – *frame elements* – in the same frame (Fillmore 1982). The same frame may be evoked by different expressions, as long as they involve the same frame elements. For example, the Removing frame (FrameNet 2021) represents a scenario where an Agent removes a Theme from a Source/Location. It may be evoked by verbs like *eliminate*, *empty*, *shave* and nouns like *removal*, as well as by syntactic constructions such as [Verb_away_NP].

Framenets are lexicographic resources organized by frames. The original Berkeley English FrameNet was designed in the 1990s (cf. Fillmore & Atkins 1992, Fillmore & Baker 2010, Ruppenhofer et al. 2016) and has since inspired the development of corresponding framenets for other languages. Although primarily designed for English, FrameNet frames have been successfully employed in multilingual computational lexicography (e.g. Boas 2009, Torrent et al. 2014). The same frames are then applied to all the languages in question, and cross-linguistic differences are attributed to the lexical units instantiating the frames. We intend to apply frames to grammatical constructions in a similar manner.

Since C. J. Fillmore and his team in Berkeley created both FrameNet and the first constructiCon, the two resources are closely related. Most other constructiCons are also developed in more or less close relation to a framenet of the same language (Russian being an exception). SweCcn is less integrated with the Swedish Framenet than the majority of constructiCons, but nonetheless two thirds of the current entries in SweCcn are linked to frames. Consequently, given the successful application of frames to multilingual lexicography and the close relation between framenets and constructiCons, relating constructions via frames is an obvious possibility for multilingual constructicography (cf. Boas 2010, Boas et al. 2019).

However, while some constructions have a frame-like meaning, others do not (Ehrlemark 2014, Lyngfelt et al. 2018a, Ohara 2018). There are also cases where the meaning of a construction

could well be characterized in terms of a frame, but no such frame description yet exists. Furthermore, since frames are semantic concepts, they can only relate constructions by their meaning, not by other properties. On the other hand, frames cover semantic notions not captured by Croft's more basic semantic CCs. Therefore, we will employ FrameNet frames in addition to other types of comparative concepts.

We can illustrate how CCs and frames can be used for linking constructions in different languages by comparing pseudo-coordinations in Swedish, for example *sitta och äta* (lit. ‘sit and eat’) to English participial constructions (*be* + V-*ing*) and Brazilian Portuguese gerund constructions (*estar* + V-*ndo*), all of which express some kind of activity in progress. Hence, they may all be linked to the FrameNet frame “Activity_ongoing”. Their different morphosyntactic realizations, however, correspond to different CCs: “coordinate personal strategy” (Sw.) vs. “verbal copula” and “action nominal” (Eng., BP). These connections are illustrated in figure 1:

Figure 1: The linking system.

In combination, frames and CCs seem to provide a versatile linking system for a multilingual ConstructiCon infrastructure. For some purposes, meaning correspondences (either frames or CCs) are more relevant, for others, morphosyntactic properties (CCs). These linking strategies may also be combined, so that constructions that match in terms of both frame and CC are more closely connected than pairings based on only one of these features.

Work packages: methods and research activities

As mentioned above, the project is built on two legs: the language-internal network development, and the cross-linguistic linking system. Formally we implement these as two integrated work packages, WP1 and WP2, where WP1 is primarily concerned with research question RQ1, and WP2 with RQ2. In combination, they address RQ3.

WP1: A comprehensive construction network for Swedish

One side of the project is the development of the language-internal network. This is not only a prerequisite for the linking model to be efficient; it also concerns fundamental questions for constructionist theory.

The main task here is to develop an account of Swedish syntax, covering (a) general phrasal and clausal constructions, as these are the central nodes of the network through which other constructions are connected, and (b) the way they interact both in the construction network and in the combination of expressions into utterances. We will approach this task in an iterative process of text annotation, construction analysis and improving the current Swedish ConstructiCon (SweCcn, version 1.0).

A crucial difference between text annotation and construction analysis is that the former marks concrete instances in particular situations, whereas the latter concerns (presumed) conventional units in the language system. The construction descriptions cannot be based on individual text occurrences alone, since the generalized construction patterns must be distinguished from traits particular to the individual instances. Therefore the constraints on the construction, both as a whole and regarding its fixed and variable elements, must also be investigated in corpora.

Text annotation of constructions is actually far less trivial than it might seem, since there is no established practice for how to do it and the annotator will have to handle constructions not yet accounted for. Furthermore, constructions may be identified at different levels of abstraction and it is not *a priori* given which levels are relevant. There is an ongoing international shared task to address this problem (see Collaboration below), and we may therefore draw on the results from this task when designing our approach.

WP2: A cross-linguistic linking system

The enterprise of aligning ConstructiCons across languages crucially depends on reliable, cross-linguistically applicable mediating structures. We propose a cross-linguistic linking system,

through which constructions are connected by shared properties, so-called *linking properties*. Construction entries may be associated with one or more such properties and thereby linked to other constructions sharing these properties, across or within languages. Which linking properties are relevant varies between different kinds of constructions as well as different purposes of the user or application, and hence the linking system should be flexible enough to be adapted to the relevant situation.

We will focus on the two kinds of linking devices described earlier: FrameNet frames and comparative concepts (CCs). Frames have been successfully applied in multilingual lexicography, and in fact, two thirds of the entries in SweCcn are already linked to FrameNet. However, not all constructions correspond to frames, and they will be accounted for by CCs, which are specifically designed for cross-linguistic comparison.

In both cases there are fairly comprehensive sets of useful descriptions available: the frames provided by FrameNet and the CCs in Croft (forthc.). This means we can import existing cross-linguistically relevant resources instead of having to define the linking properties ourselves, thereby reducing the risk of language bias and keeping within a feasible time frame.

Collaboration and dissemination

International collaboration

There are currently ongoing constructiCon projects for six languages, the other five being Brazilian Portuguese, English, German, Japanese and Russian, and we have a long-term ongoing collaboration with all of them. One side of this collaboration concerns methodology for constructiCon development, another aims for cross-linguistic alignment and application. Parts of the cross-linguistic linking system proposed here stem from joint discussions with the Brazilian team (cf. Lyngfelt et al. forthc.), which has initiated a related enterprise from the viewpoint of Portuguese (e.g., Tavares in prep.). This collaboration towards a shared goal will continue to our mutual benefit. We also maintain constructive discussions with Bill Croft regarding the use of CCs in constructicography and participate in the international FrameNet community.

Shared annotation task

A particularly relevant pilot project involving all the six languages mentioned is a shared task of full-text annotation of constructions. Working on translations of the same text, the various research groups annotate “all” constructions in the text, with an open mandate to interpret “all” any way they like, which makes the project particularly interesting from a methodological perspective. We expect this ongoing work to provide insights to both which constructions need to be accounted for and how to handle relations between constructions – within and across languages. The text annotation in WP1 will build on the results from this shared task.

National collaboration

Two lines of collaboration within Sweden should also be mentioned. On the one hand, SweCcn is part of a larger infrastructure of digital linguistic resources at *Språkbanken Text* at the University of Gothenburg (Borin et al. 2012, Lyngfelt et al. 2018a). Building on previous approaches to combining SweCcn with NLP (Forsberg et al. 2014), and with grammar formalisms (Grūzītis et al. 2015), we will continue the integration of SweCcn with the infrastructure of *Språkbanken Text*. On the other hand, we collaborate with second language researchers to make SweCcn useful for second language education (Loenheim et al. 2016, Prentice & Lyngfelt 2016, Håkansson et al. 2019).

Dissemination plan

The results will be made publicly available online through the SweCcn resource as well as through publications and presentations, both scientific and for applied practices, e.g. second language education.

Due to the corona pandemic, it is hard to tell when or how relevant conferences will take place, but possible dissemination options include the following conference series: *International Conference of Construction Grammar* (ICCG), *International Cognitive Linguistics Conference* (ICLC), *International Conference on Language Resources and Evaluation* (LREC), *Constructions in the Nordics* (CxGN), and *Svenskans beskrivning* (Svebe). We will also present our work at events addressing the general public, such as the *Grammar Festival* and the *Science Festival*.

In addition to conference participation, we intend to publish in journals such as *Nordic Journal of Linguistics*, *Constructions and Frames*, *Language Resources and Evaluation*, and the book series *Constructional Approaches to Language*.

Dissemination in applied areas will be conducted in close collaboration with practitioners in second language education and language technology.

Participants

Name	Position (title)	Specialty
Benjamin Lyngfelt (BL)	professor	PI, CxG, syntax, SweCcn
Maia Andréasson (MA)	associate professor (docent)	LFG, information structure, grammar didactics
Kristian Blensenius (KB)	PhD	lexicography, FrameNet, SweCcn

Linnéa Bäckström (LB)	PhD	CxG, SweCcn
Steffen Höder (SH)	professor	CxG, contact linguistics
Peter Ljunglöf (PL)	associate professor (docent)	formal grammars, computational linguistics
NN-sd	systems developer	

The systems developer will be provided by *Språkbanken Text* at the University of Gothenburg.

Research plan

During the first year of the project, SweCcn will be upgraded to include the linking system, existing entries will be connected, and descriptive gaps will be inventoried, analyzed and begin to get covered. By the end of the second year, the main part of the descriptive work should be in place. In the third year, the system will be elaborated and fine-tuned, and adapted to application to language technology and language pedagogy.

The dependencies between the subpackages are shown in figure 2 (right below), and the timeline of the project is in figure 3 (bottom).

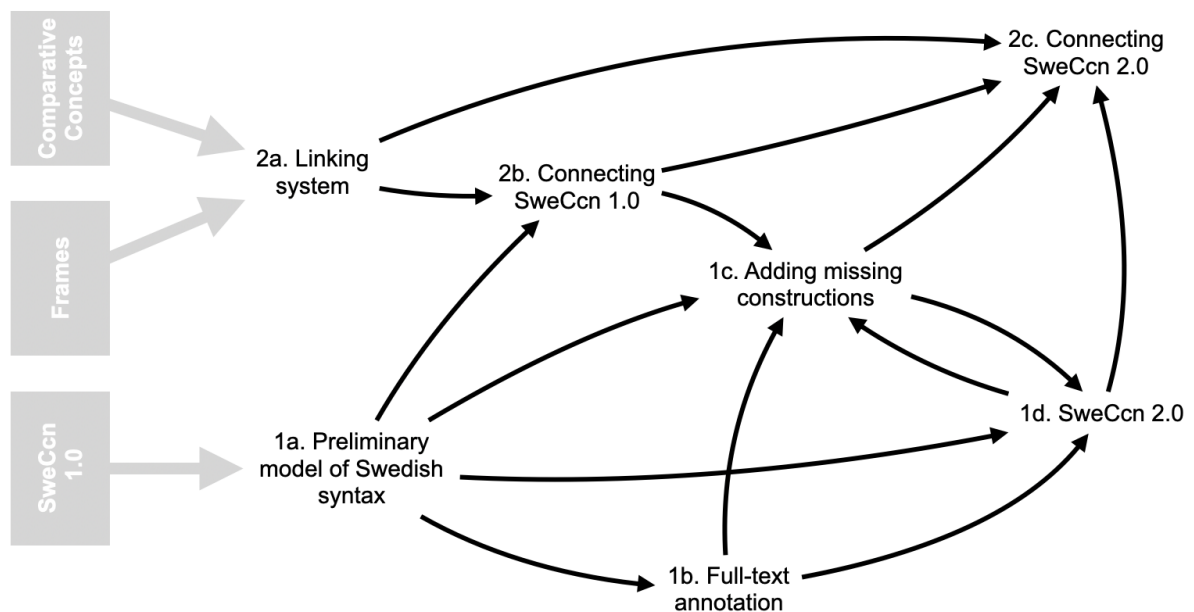


Figure 2: How the work packages depend on each other

WP1. A comprehensive construction network for Swedish

(Addressing RQ1 and language-internal aspects of RQ3.)

1a. Preliminary model of Swedish syntax (MA). We will work out a preliminary constructionist model of Swedish syntax, including general clausal and phrasal patterns and a system for how (expressions instantiating) constructions are combined into utterances. This model will be based on SweCcn 1.0 and will feed into **1b**, **1c** and **1d**.

1b. Full-text annotation (KB). Using the preliminary results from **1a**, and also **3a**, we will perform full-text construction annotation of sample texts, both to test the existing model and construction descriptions and to identify more construction candidates. In this we continuously evaluate the outcomes of **2a** and **2c** in an iterative process.

1c. Adding missing constructions (LB). Overlapping with **1b**, SweCcn will be strategically explored with the main objective of establishing which missing constructions are critical for the Swedish ConstructiCon. These will be investigated and then added to SweCcn, thus creating a more systematic and coherent network. This step may also include updates of the syntax model from **1a** and revision of existing construction entries if needed.

1d. SweCcn 2.0 (BL). The process outlined in **1a–1c** will lead up to the development of an updated SwCcn 2.0, i.e. a working constructionist model of Swedish, organized as a comprehensive construction network and integrated with the cross-linguistic linking system.

WP2. A cross-linguistic linking system

(Addressing RQ2 and cross-linguistic aspects of RQ3.)

2a. Linking system (PL). In this subpackage we will create a common infrastructure for FrameNet frames and comparative concepts, to be used as a system for linking constructions across and within languages.

2b. Connecting SweCcn 1.0 (KB, SH). We will connect existing Swedish construction entries to appropriate FrameNet frames (KB) and comparative concepts (SH), using the linking system developed in **2a**.

2c. Connecting SweCcn 2.0 (SH). The linking system will be updated with new construction entries developed in **1c** and other improvements to the resulting Swedish ConstructiCon 2.0 resource that will be developed in **1d**.

WP3. Collaboration and dissemination

3a. Shared annotation task (KB). Partly preceding, partly overlapping with the project, we partake in a shared annotation task involving all the ongoing ConstructiCon projects. This task will inform **1b**.

3b. International workshops (all). The annotation task **3a** will be followed up by a workshop, organized jointly with the German and Brazilian groups. We will also organize an international workshop on multilingual constructicography during project year 2.

3c. External meetings (all). In addition to the workshops, we plan to have recurring online collaboration meetings with our international ConstructiCon partners.

3d. Publication (all). We plan to publish continuously over the project period, with at least one major international publication per year, and more at the end of the project. This is only schematically outlined in the time plan below.

Activities	2022				2023				2024			
WP1. A comprehensive construction network for Swedish												
1a. Preliminary model of Swedish syntax												
1b. Full-text annotation												
1c. Adding missing constructions												
1d. SweCcn 2.0												
WP2. A cross-linguistic linking system												
2a. Linking system												
2b. Connecting SweCCn 1.0												
2c. Connecting SweCCn 2.0												
WP3. Collaboration and dissemination												
3a. Shared annotation task												
3b. International workshops												
3c. External meetings												
3d. Publication												

Figure 3: Project timeline