The evolution of spatial rationales in Tesnière’s stemmas

Nicolas Mazziotta
Centre de linguistique française, générale et romane (UR Traverses)
Université de Liège
nicolas.mazziotta@uliege.be

Abstract

This paper investigates the evolution of the spatial rationales of Tesnière’s syntactic diagrams (stemma). I show that the conventions change from his first attempts to model complete sentences up to the classical stemma he uses in his Elements of structural syntax (1959). From mostly symbolic representations of hierarchy (directed arrows from the dependent to the governor), he shifts to a more configurational one (connected dependents are placed below the governor).

1 Introduction

The constant use of diagrams is one of the most famous characteristics of Tesnière’s Éléments de syntaxe structurale (Tesnière, 1959) (henceforth, Elements). These diagrams, known as stemmas in this work, are visual representations of the syntactic analysis of sentences, i.e. words and the syntactic relations between them. In this paper, I will focus on the comparison between Tesnière’s first stemma – observed in his drafts and in (Tesnière, 1934a) – and the « classical » ones he draws in his Petite grammaire russe (Tesnière, 1934b, 157, 162 and 164) as well as in his Esquisse d’une syntaxe structurale (Tesnière, 1953) and his Elements. From the early stemmas to the classical ones, Tenière changed the graphical elements and the configurational rules at work to achieve what he thought was a better representation of his analysis – his pedagogical concerns were prominent (Tesnière, 2015, Chapters 276-277).

Before I delve into the details of the stemmas, I would like to introduce my perspective and my motivation. My perspective is mostly a semiotic one: the description of the mechanics of diagrams as bidimensional graphical formalisms. Semioticians of peircian obedience (Stjernfelt, 2007) describe diagrams as complex icons, i.e. signs that share structural characteristics with what they represent. For instance, a map is an icon of the territory it represents, because areas on the map and symbols used are placed in accordance with the location of elements of interest of the territory (Bertin, 2005). This paper will often deal with a recurrent issue in the description of diagrams: the evaluation of the relevance of the observed graphical elements and the way they are laid out on the plane. What is incidental? What does, indeed, qualify as an icon, and is genuinely diagrammatical? For instance, the thickness of the strokes in all the stemmas reproduced in this paper is incidental. It does not represent anything at the conceptual level: some may be thinner than others with no consequences on information.

My motivations are epistemological and methodological. By emphasizing the evolutions of graphical rationales proposed by a major historical author in the field, I intend to draw attention to the fact that most syntacticians apply formal conventions to encode analyses in graphical inscriptions. These conventions actually constraint what can be expressed.

In this historical survey, I will proceed from the classical diagrams of the Elements to the earliest ones, mainly because whereas the formers are sometimes remembered, the latters are almost completely forgotten. I will introduce Tesnière’s conceptual rationales as well as the theoretical foundations of my analysis alongside the analysis itself. In the conclusion, I will show that the characteristics of the alternative types of stemmas are still relevant to solve specific problems in linguistics.

1 In this conception, which I will not investigate here, diagrams are tools that allow for discovering novel knowledge about what they represent (Stjernfelt, 2007, 99-105).
2 Classical stemmas

The foundational idea in the *Elements* is that words are not the only elements of the sentence, but that there exist syntactic relations that can also be qualified as elements:

a sentence of the type *Alfred speaks* is not composed of just two elements, *Alfred* and *speaks*, but rather of three elements, the first being *Alfred*, the second *speaks*, and the third the connection that unites them, without which there would be no sentence. To say that a sentence of the type *Alfred speaks* consists of only two elements is to analyze it in a superficial manner, purely morphologically, while neglecting the essential aspect that is the syntactic link (Tesnière, 2015, Chapter 1, § 5, emphasis from the author)

In this section, I first describe how these basic elements are represented in the graphical medium (2.1) and how they combine on each axis of the plane (2.2). To do so, I formulate discursive descriptions of the diagrams. The last subsection deals with more complex configurations (2.3).

2.1 Graphical entities

In accordance with his epistemological stance, Tesnière draws stemmas that consist of arrangements of discrete graphical items. In semiotics, the Groupe µ (1992) proposed the concept of *graphical entities* (or *entities*, for short). Entities are *Gestahlt*, i.e. forms that, from a cognitive perspective, can be identified and described as single objects; e.g.: a dot, an arrow, a face, a car, etc. (henceforth, entities will be noted using a fixed-width font). They do not need to have a meaning to qualify as entities; e.g. an *arrow* can be recognized as such without knowing how to interpret it. This characteristic is especially important in learning procedures: one can recognize *strokes* in fig. 1 (Tesnière, 1959, Chapter 3, § 8) before being instructed about how to understand them – although our background knowledge provides us with very good insight.

(1) Alfred frappe Bernard
    ‘Alfred hits Bernard’

Figure 1: Classical stemma of (1)

In the stemmas of the *Elements*, such as fig. 1, entities represent linguistic signs (“words”) as well as relations. In the terminology I will use henceforth, words and relations are analytical concepts that are *reified* (Kahane and Mazziotta, 2015b; Mazziotta, 2016b) in the diagram: entities are used to represent them in a discrete way on the graphical substratum.² The basic inventory of graphical entities in these diagrams is thus:

1. Words at use in the sentence are reified by entities that can be called *words*, i.e. a graphical image of the linguistic units.

2. Relations are reified by *strokes*.

²The history of syntactic diagrams demonstrates that it is possible to conceive diagrams that do not reify relations. See, e.g. the diagrams by Clark or Reed and Kellogg (Brittain, 1973; Mazziotta, 2016a).
2.2 Configurational rules and super-entities

For them to work as tools for the linguists, stemmas have to be organized in accordance with a specific syntactic analysis.\(^3\)

“le stemma note toujours une correspondance point par point avec les opérations qu’il est censé représenter” ['elements in the stemma always strictly correspond to the operations it is supposed to represent'] (Samain, 1995, 131, my translation)

Therefore, to fully understand the rationales of the stemmas, one must achieve a description of the rules that govern the combination of entities in correspondence with Tesnière’s syntactic epistemology (i.e. the represented “operations”). To do so, one needs to remember the basic theoretical rationales of tesnierian syntax.

**Syntactic rationales.** There are two major kinds of syntactic relations that are reified in classical stemmas. The first one is connection (Tesnière, 2015, Part 1). A connection between two words is hierarchized and asymmetrical. It corresponds to a subordination relation and it is very close to the modern concept of syntactic dependency. Connections in (2) are illustrated in fig. 2 (Tesnière, 1959, Chapter 3, § 8). The second type of relation occurs between words that share the same grammatical function, i.e. coordinations and appositions. It is called junctions in Tesnière’s terminology. The junction between *Alfred* and *Bernard* in (3) is illustrated in fig. 3 (Tesnière, 1959, Chapter 134, § 4).

(2) Mon vieil ami chante cette fort jolie chanson
   ‘My old friend sings this very nice song’

(3) Alfred et Bernard tombent
   ‘Alfred and Bernard fall’

![Figure 2: Classical stemma of (2): connections](image)

Words and strokes are graphically arranged according to rules that distinguish between connection and junction. As I will explain, the most important rules governing the spatialization (their spatial organization) of the classical stemmas can be described by focusing on the behaviour of entities on the vertical axis.

**Vertical axis.** Each extremity of a single stroke is close to a word. This corresponds to a syntactic relation between words. The distinction between the two types of relations is expressed by the relative vertical coordinates of the two words:

\(^3\)See also (Petitot, 1995).
• Words that are linked together by a connection are reified by \textit{words} that do not have the same vertical coordinates. The one that is located higher on the plane corresponds to the governor; the lower one to the dependent.

• Words that are bound by a junction are reified by \textit{words} that have the same vertical coordinate.

• The corollary of these first two rules is that the topmost \textit{word} represents the root of the syntactic hierarchy.

Such configurations of \textit{words} and \textit{stroke} are super-entities that can be interpreted as wholes (\textit{Gestalt}). Therefore, a \textit{connection} is a super-entity consisting in two \textit{words} with different vertical coordinate, connected by a \textit{stroke}. Similarly a \textit{root} is the topmost \textit{word} of the stemma.

Two important additions to these rules are necessary. Firstly, in the case of junctions, the description remains unsatisfactory so far. The junctor \textit{et} is not, from a linguistic perspective, coordinated with either of the conjuncts. The second rule I just stated is not sufficient. Furthermore, there are stemmas in the \textit{Elements} (e.g. see stemma 266) where junction occurs without any junctor (asyndesis). In this case, a single \textit{stroke} is drawn between the \textit{words} that reify the conjuncts. To solve this, one must posit that there can be two alternative reifications of junction: (i) the entity reifying the junction is a single \textit{stroke} and; (ii) the entity reifying the junction is a \textit{stroke} interrupted by a \textit{word}.\footnote{"If the junction is marked by a junctive, the junction line will be constituted by two parts. The junctive appears between these segments." (Tesnière, 2015, Chapter 136, § 3) See also (Mazziotta, 2014, 145-146).} From a cognitive perspective, both entities are junctions, i.e. graphical representations of junctions (fig. 4)\footnote{The first stemma is reconstructed to provide simple comparison material. The second one is extracted from fig. 3}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{Variety of the junction}
\end{figure}

Secondly, \textit{words} that are at the same level of distance of the \textit{root} have the same vertical coordinate. This convention is implicit in the \textit{Elements}, and probably due to the requirement of printing a visually pleasing book.\footnote{Tesnière hardly ever suggests that a distinction between the vertical coordinates of co-dependent could be meaningful – see stemma 296, Chapter 169, §§ 19-20 for a unique discussion on the subject.} The cognitive consequence of co-dependents consistently having the same vertical coordinates is that syntactic distance between a word and its descendents is iconically represented, and can be grasped in a single glimpse.

\textbf{Horizontal axis.} The semiotic values of the horizontal coordinates of the \textit{words} is not similar to the values of the vertical coordinates.

First of all, the horizontal axis plays a major ergonomic role. For the sake of readability, entities may not overlap.\footnote{In sciences, diagrams may display some tolerance with respect to this constraint (e.g. scatterplots often have overlapping elements).} In accordance with configurational rules and with this ergonomic constraint, the following are simple corollaries:

• Junction \textit{strokes} are horizontal.

• Connection \textit{strokes} are vertical or slanted.

Despite being corollaries, these properties have major cognitive consequences: the slope of a \textit{stroke} can be used to instantly tell apart the two types of entities in structures that look like trees.\footnote{Although stemmas are not trees from a mathematical perspective (Kahane and Osborne, 2015; Mazziotta, 2014).} Tesnière insists that the stemma is a representation of the syntactic structure (or \textit{structural order}), rather than the \textit{linear order} of the words (Tesnière, 2015, Chapter 4 sqq.). The horizontal positioning of the \textit{words} that represent co-dependents of the same verb actually corresponds to a distinction between the kinds of dependencies between them: the subject, the object and the oblique complement are placed, in this order, before the adjuncts, with no respect to the linear order – fig. 5 depicts (4). Such a convention only affects the dependents of the verb.
(4) Marie vous rendra sûrement votre livre demain
Mary you.DATIVE will give back certainly your book tomorrow
‘Mary will certainly give you back your book tomorrow’

Figure 5: Horizontal order in classical stemmas. See infra (2.3) about the letter “E” occurring next to connection strokes.

Aside from that, horizontal coordinates have hardly any structural values: the only other constraint is ergonomic (entities cannot overlap). By default, the words are horizontally arranged according to the linear order of the sentence, but since this convention is not bound to the theoretical foundations, it remains mostly incidental.9

2.3 Complex configurations

The main configurational rules between words and strokes are somewhat minimalistic, but as Tesnière wants to refine the analysis, he adds complexity to the system in two ways: by using entities that look like words as labels and by introducing a special entity to encode a special syntactic operation: transfer.

Labels. The fact that relations are reified make it possible to make visual statements about them.10 Some strokes have labels. Letters or numbers that are placed in the direct proximity of the stroke. For instance, in fig. 5, the label “E” qualifies a stroke as a representation of an adjunct relation (Fr. circonstant in Tesnière’s terminology). In many cases, words and labels share the same components (letters): only their positions in the stemma can help distinguishing between them.

Transfer. Tesnière also uses another complex graphical entity to represent an operation that he calls transfer (Fr. translation) (Tesnière, 2015, Part 3). In Tesnière’s model, words have a natural syntactic potential that corresponds to the word classes they belong to; e.g., an adjective naturally depends on a noun and a noun naturally depends on a verb. By the means of grammatical markers such as case endings, prepositions and conjunctions, words can be transferred from one class to another in order to depend on a word belonging to an incompatible class. For instance, a word like Peter is a noun, that cannot depend on another noun, unless it is transferred, by the genitive case, to become an adjective. Tesnière gives (5) as an example.

(5) le livre d’Alfred
the book of Alfred
‘Alfred’s book’

Hence *le livre Alfred vs. le livre d’Alfred. The transfer relation is reified by a stylized T, such as the one in fig. 6.

Tesnière describes two types of transfer (Tesnière, 2015, Part 3). The ones similar to the aforementioned example d’Alfred, and the ones that imply the subordination of a clause, i.e. a structure governed by a finite verb. The former are “first-degree transfers” and the latter are “second-degree transfers”.

9 Scholars of different disciplines have suggested to use the horizontal axis exclusively to encode linear order (Ihm and Lecerf, 1963; Bertin, 2005; Groß, 1992).
10 See note 2 about systems that do not reify relations.
The stylized T is a complex super-entity consisting of many arranged subentities. From a cognitive perspective, this entity is perceived as a whole (Gestalt) and the description of its parts is only relevant with respect to configurational conventions:

- The word representing the transferred word is placed on below the horizontal bar of the stylized T on the side where the lower part of the stylized T is slanted.
- The word representing the grammatical means used to transfer the word is placed on the other side.
- A label, identifying the resulting word class,\(^\text{11}\) is placed on top of the stylized T.
- The horizontal bar is doubled in order to represent second-degree transfer.

The super-entity formed by the stylized T and the two aforementioned words behaves like a word with respect to all configurational rules.

3 Early stemmas

In this section, I study early stemmas in comparison with classical ones, in order to emphasize the contrasts between two different diagrammatic conventions of similar analyses.

The epistemological grounding and the main theoretical choices characterizing Tesnière’s early stemmas are similar to the ones of the classical stemmas: relations are reified (Section 2) and connection and junction are distinguished (2.2). The first handcrafted stemma is found in the correspondence between Tesnière and Fernand Mossé in 1932.\(^\text{12}\) The first – and to my knowledge only – printed early stemmas appear in “Comment construire une syntaxe” ['How to build a syntax'] (Tesnière, 1934a). Only two stemmas of this kind have been published, and we have yet to find other drafts using the same conventions in Tesnière’s archive (BnF NAF 28026).

Tesnière (1934a, 225) draws the stemma of (6) – fig. 7.\(^\text{13}\)

(6) De même qu’on voit un grand fleuve qui retient encore, coulant dans la plaine, cette force violente et impétueuse qu’il avait acquise aux montagnes d’où il tire son origine; ainsi cette vertu céleste, qui est contenue dans les écrits de saint Paul, même dans cette simplicité de style, conserve toute la vigueur qu’elle apporte du ciel d’où elle descend. (Bossuet, Panégyrique de saint Paul)

‘As we see a large river that still retains, running across the plain, this violent and impetuous strength it had gained in the mountains it originates from; similarly, this celestial virtue found in the scriptures of saint Paul, even when the style is simple, keeps all the vigor it brings from the heaven it comes down from.’ (my translation)

I will now review the graphical entities of this early stemma (3.1) as well as their configurational rules (3.2). The last part of this section will focus on transfer (3.3).

\(^{11}\)Tesnière uses the following labels: ‘T’ for “verb”, “O” for “noun”, “A” for “adjective” and “E” for “adverb” (Tesnière, 2015, Chapter 33).

\(^{12}\)See (Mazziotta and Kahane, Forthcoming). Tesnière has written a letter on the matter on the 26th of July 1932 and the box at the BnF (NAF 28026) contains an early stemma analyzing the Latin sentence that candidates of the French baccalauréat had to translate.

\(^{13}\)Swiggers (1994, 215) provides a copy of the stemma, but neither this paper nor the original publication are easily accessible. There are several errors in this early stemma (probably made by the publisher). Un should connect with fleuve (not with grand), the direction of the arrow connecting elle to apporte should be inverted, and vigueur should connect with apporte (and not elle).
3.1 Graphical entities

The graphical entities at use in the early stemmas correspond to the words and the relations represented in the classical stemmas:

- **Words** reify words of the sentence in a similar manner as they do in classical stemmas (2.1). The word that corresponds to the root is capitalized.
- **Three kinds of arrows** reify syntactic relations. The internal structure of arrows is worth considering. The discontinuities in the stroke composing some arrows are incidental, but arrow heads are similar to labels that identify different types of arrows, and, consequently, of relations:
  - **simple arrows** “→” correspond to connections;
• double arrows “↔” correspond to junctions;\textsuperscript{14}
• two-headed arrows “↠” correspond to a special type of connection (see \textsuperscript{3.3}).\textsuperscript{15}

It is already clear that early stemmas use symbolic conventions to distinguish between different types of relations. By contrast, classical stemmas use simple \textit{strokes} that need to be spatialized in order to be identified as the reification of specific relations. Configurational rules are set accordingly.

3.2 Configurational rules

The configurational conventions between \textit{words} and \textit{arrows} of all kinds are:

- Similarly to \textit{strokes} in classical stemmas, \textit{arrows} connect \textit{words} that appear at both extremities.
- \textit{Single arrows} and \textit{two-headed arrows} express a hierarchy. The \textit{word} representing the governor is placed near the \textit{arrow head} and the one representing the dependent at the other extremity.

As in classical stemmas, coordination also deserves a closer look. There is no hierarchy between the words and the first of the two aforementioned rules is sufficient to describe the behavior of the entities reifying conjuncts. The specific convention is that the \textit{word} that reifies the coordinator is used similarly as \textit{labels} in classical stemmas: it is placed beside the \textit{dual arrow} (\textit{et} in fig. 8).

\textbf{Figure 8: Junction in early stemmas}

The recursive application of the configurational rules in early stemmas leads to a \textit{gravitational} representation of the sentence – Tesnière uses the French term \textit{gravitation} to describe the relationships in his system (Tesnière, 1934a, 224). Words that depend on a governor are represented by \textit{words} surrounding the \textit{word} corresponding to the governor. Both axes of the plane are used simultaneously: it is not possible to identify a specific function for one, that the other would not share. Furthermore, the two corollaries identified in classical stemmas (namely that junctions are represented by \textit{strokes} that look horizontal and connections by \textit{strokes} that look vertical or slanted) cannot be used to easily locate different kinds of relations. No configurational contrast can encode this difference, which is expressed by symbolic means: the kind of \textit{arrow} at use.

Another major consequence of this behavior is the way syntactic distance is made visible (2.2). As a first approximation, it might seem that graphical distance iconically represents this syntactic distance. However, the graphical distance between words is never sufficient to express the syntactic hierarchy: it must be supplemented by \textit{arrows}, the length of which is not relevant. For instance, in fig. 7, the arrow between \textit{simplicité} and \textit{CONSERVE} is longer than both arrows linking \textit{même} to \textit{voit} through \textit{que}. Graphical distance may incidentally correspond to syntactic distance, but only the count of \textit{arrows} implied and their directions are relevant.

Additionally, the slopes of the \textit{arrows} do not correspond to anything in the syntactic analysis. The arrow between \textit{vigueur} and \textit{CONSERVE} is orthogonal to the one between the latter \textit{simplicité}. This contrast has no value in the diagrammatic system, as stated by Tesnière:

\textit{Ses subordonnés directs sont placés devant, derrière, au dessus ou au dessous, peu importe.} ['Its direct subordinates are placed in front, behind, below or on top [of the governor]; it does not matter.'] (Letter to Mossé, 26 Jul. 1932; BnF NAF 28026)

The direct consequence of this free placement is that the \textit{word} corresponding to the root element of the sentence cannot be identified by its positionning in the diagram alone: the central position of \textit{CONSERVE}

\textsuperscript{14}Note that in the first draft of an early stemma, Tesnière uses a simple \textit{stroke} instead (BnF NAF 28026, B42, 148B).
\textsuperscript{15}In his drafts, Tesnière uses a \textit{crossed-out arrow} rather than a \textit{two-headed arrow}: “Nous l’indiquons par une flèche barrée […]” ['We note this by the means of a crossed-out arrow'] (Tesnière, 1934a, 228, note 1).
is also incidental. Therefore, the root is identified by the means of a symbolic convention (the use of capital letters). Configurational rules would suffice to identify it, not in a cognitive-efficient way, but rather by evaluating the direction of each arrow in the diagram.

3.3 Representation of transfer

Although Tesnière had already elaborated the concept of transfer by the time he published his first stemmas (Tesnière, 1934a, 227-228), the entities and the configurational rules do not encode transfers in a straightforward way.

Fig. 9 is the fragment of the stemma that depicts the analysis of “cette vertu qui est contenue dans les écrits de saint Paul” [‘this virtue found in the scriptures of saint Paul’]. From a linguistic point of view, the construction de saint Paul is similar to d’Alfred: both are PPs, and both are analyzed as transfers by Tesnière.

![Figure 9: Dependents and translatives in early stemmas](image)

However, there is no difference between a dependent and a translative in stemmas such as fig. 9: de (translative) and saint (adjective) are both connected to Paul by the means of “→”.

Only second-degree transfers can be identified, since a special type of arrow “↠” connects a subordinate finite verbs to their governors. However no convention can tell apart the translative from any other dependent: in fig. 9, the translative qui ‘who’ has the same status as the dependent contenue ‘contained, found’.

4 Conclusion

Classical and early stemmas use two different sets of diagrammatical entities and rules of spatialization. Tab. 1 summarizes the comparison. Both systems have in common that words are reified by words and that relations are reified by specific line-like entities drawn from one word to another. Classical stemmas confer a greater importance to configurational means of representing syntax, whereas earlier ones favor symbolic means. This has cognitive consequences. The conventions of the classical stemmas allow for a straightforward identification of key elements of the analysis by the means of geometric properties:

- the root of the stemma is reified by the topmost word;
Table 1: Classical vs. early stemmas

| Classical stemmas | Early stemmas |
|-------------------|---------------|
| word              | word (2.1)    |
| relation          | stroke (2.1)  |
| relation type     | relative position and slope (2.2) |
| syntactic distance| vertical distance (2.2) |
| transfer          | stylized T (2.3) |
|                   | word (3.1)    |
|                   | arrow (3.1)   |
|                   | arrow head (3.1 and 3.2) |
|                   | arrow count (3.2) |
|                   | (hardly present, 3.3) |

- dependents of the same level are reified by words on the same horizontal line;
- the distinction between connection and junction corresponds to the slope of the strokes.

These straightforward arrangements are not available in early stemmas, which use symbolic conventions, such as the use of capitals for the root, the use of different arrow heads, etc.

Furthermore, surveying the evolution of diagramming systems actually helps understanding issues that are still relevant today. Tesnière’s stylized T and flexibility in the choice of diagrams are two illustrations of the link between diagram use, theoretical debate, and efficiency of expression. As exposed in this paper, Tesnière tried to elaborate minimalistic conventions, but he somewhat failed in the case of transfer. The stylized T remains the most idiosyncratic entity he uses, and I have not heard of any colleague using it to make diagrams. Nevertheless, it is striking that the invention of such bizarre entities is actually possible without breaking the rest of the system. The stylized T behaves like a word, and it solves the distinction problem between dependent and translatives (3.3). By positioning translatives in a specific way on the stemma, Tesnière brings his own answer to the problem of function words in dependency syntax – a problem that still cannot be solved in a consensual way (Kahane and Mazziotta, 2015a; Osborne and Gerdes, 2019).

The choice between configurational and symbolic means to express components of syntactic analysis is still a constant issue in modern dependency linguistics. Careful linguists try to select the diagrammatic conventions that suit their demonstration. For instance, Mel’čuk usually uses a configurational system (fig. 11a), but he favors symbolic conventions to represent dependencies when he wants to evaluate projectivity (fig. 10). By doing so, he makes it possible to visualize crossing arrows (Mel’čuk, 1988, 37).

Figure 10: Symbolic conventions express projectivity violations

Symbolic devices are convenient, since not relying on spatialization gives more freedom for geometric arrangement. For instance, as illustrated by fig. 11 (Mel’čuk and Iordanskaja, 2015, 26 and 34), the authors’ usual way to draw a dependency tree combines the main configurational principles of classical

\[\text{French: I\'en connais déjà las-fin} \]
\[\text{I of this know already the end} \]
\[\text{\'I know already the end of this (of it).} \]
\[\text{... l\'histoire don\'t je connais las-fin} \]
\[\text{the story whose I know the end} \]
\[\text{\'the story of which I know the end} \]

\[\text{Although such an answer may actually be seen as a constituency-based solution (Osborne, 2013). For a presentation of the possible structural interpretations of transfer, see (Kahane and Osborne, 2015, 1-1x).} \]
\[\text{The use of arrows (the convention is the opposite of Tesnière’s) is redundant, because the vertical arrangement already expresses the direction of dependencies.} \]
\[\text{Of course, this is not the only way to visualize projectivity violation; e.g. the early diagrams by Ihm and Lecerf (1963, 10) duplicate the words and align them on a projection stroke, which is still a common practice.} \]
stemmas with arrows and labels interrupting them. When adding boxes and arrows reifying the communicative structure to a dependency tree, they actually move the first dependent of \textit{go up} further to the left, with absolutely no consequence on the meaning of the diagram, thus leaving space for adding a new box.

In his stemmas, Tesnière had to cope with some theoretical issues that still find concurrent solutions in modern linguistics. Sometimes these various solutions are incompatible, because they acknowledge different views of syntax. Sometimes diagrammatic flexibility is a way to achieve a better visualization of the reasoning. Differences may be incidental from a formal point of view, but they are of utmost importance from a cognitive perspective.

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