Logic versus theory of language in the late 19th century

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The linguistics background

Franz Bopp (1791–1867) to
Karl Brugmann (1849–1919):
Comparative linguistics, historical linguistics,
history of indoeuropean vocabulary and
inflections

Wilhelm von Humboldt (1767–1835):
The world's languages,
their classification in terms of
grammar and national characteristics

Heymann Steinthal (1823–1899),
Moritz Lazarus (1824–1903)
and Wilhelm Wundt (1832–1920):
Language as a branch of psychology and
'Völkerpsychologie'

Also a tradition of language teaching, as in Frege's father's text (1862) for 9 to 13 year olds.

In this tradition, tree diagrams were often used for grammatical analysis.

Billroth (1832):

Miltiades ——————— reddidit
  | | ╲
 dux   libertatem   ↘ in pugna
  | | |
Atheniensium   oppressam Graeciae apud Marathonem
                       | |
                     paene   toti
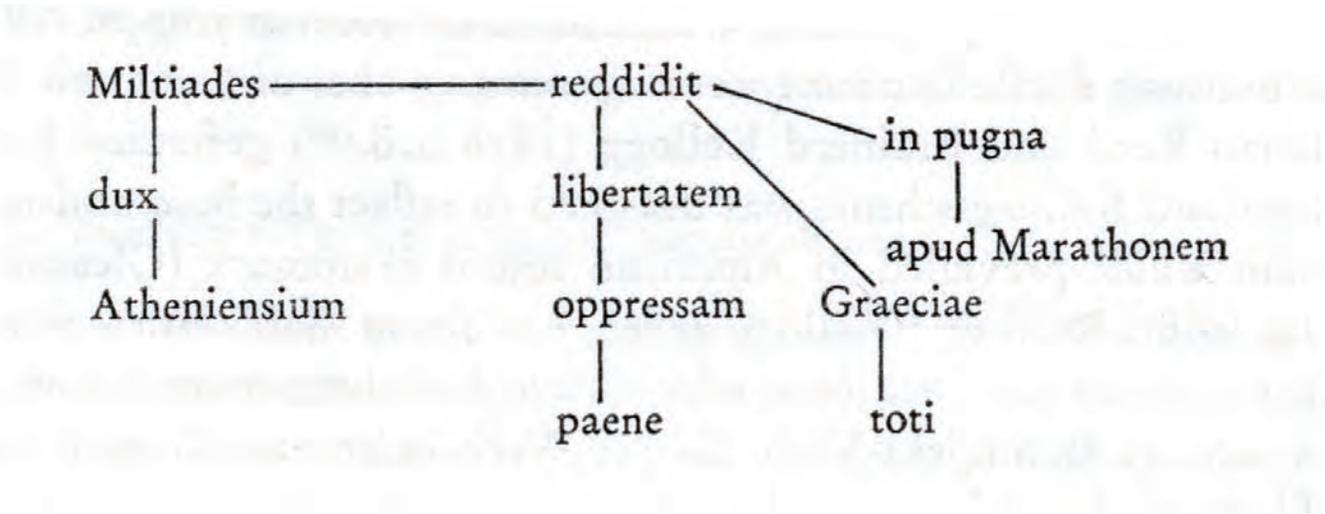
Gottlob Frege was probably the first to use trees as a tool of language theory, in *Begriffsschrift* (1879):

$$\overset{\mathfrak{d}}{\frown}\overset{\mathfrak{a}}{\frown}\quad \frac{\gamma}{\tilde{\beta}}f(m_\gamma, \mathfrak{a}_\beta)$$

$$\frac{\gamma}{\tilde{\beta}}f(\mathfrak{a}_\gamma, m_\beta)$$

$$f(\mathfrak{d}, \mathfrak{a})$$

$$\frac{\gamma}{\tilde{\beta}}f(m_\gamma, \mathfrak{d}_\beta)$$

$$\frac{\gamma}{\tilde{\beta}}f(\mathfrak{d}_\gamma, m_\beta)$$
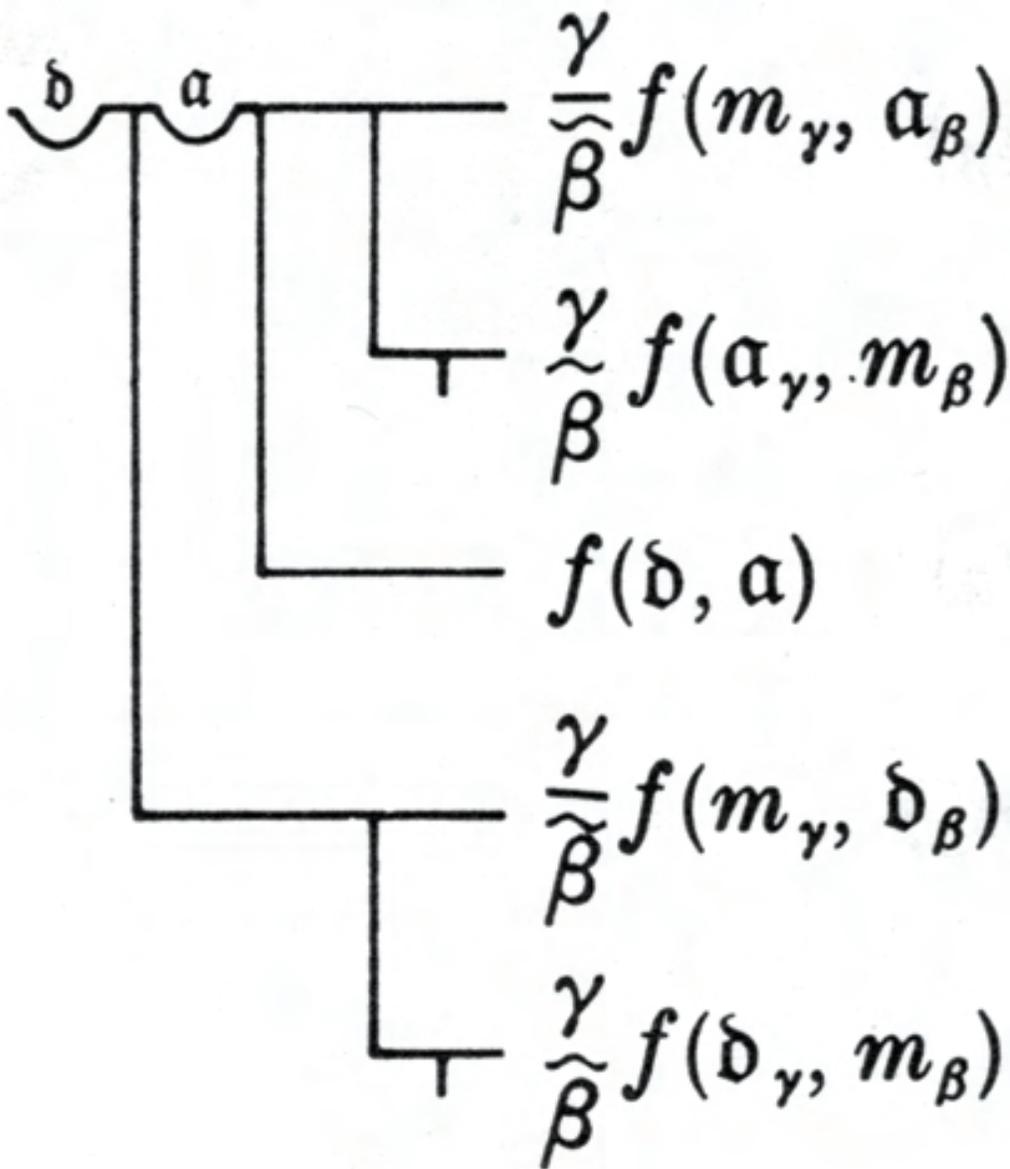
The logic background

Aristotle's pattern
concept $\Rightarrow$ *judgement* $\Rightarrow$ *inference*
and his simple argument types.

Antoine Arnauld, Claude Lancelot, Pierre
Nicole:
*Grammaire générale et raisonnée de
Port-Royal* (1660)
Logique ou l'Art de penser (1662).

Immanuel Kant (1724–1804) lectures on
logic, using as text Meier's
Auszug aus der Vernunftlehre (1752).

John Stuart Mill (1806–1873) marries
aristotelian logic to English empiricism in his
A system of logic (1843).

Whately, De Morgan apparently unknown in
Germany, Bolzano and Boole almost
unknown.

Catchwords of late 19th century

Lazarus, *Über das Verhältnis des Einzelnen zur Gesammtheit* (1862)
'On the connection of the individual items with the whole'.

One finds studies of the part/whole relationship of

> people in nations
> words in sentences
> atoms in molecules

and above all, representations ('Vorstellungen') in mental acts.

J. F. Herbart (1776–1841), Kant's successor, talks of association of representations, and 'melting together of inner determinations'.

R. H. Lotze (1817–1881), *Logic* (1843):

'One can easily throw together plain spheres to make a heap, if it doesn't matter how they lie.
But to make a structure with a regular shape, we must have building blocks, each of which has already been given a suitable form so that the surfaces of the blocks fit each other, allowing them to be added and layered more securely.
We should expect the same to apply here [i.e. to the combination (Verknüpfung) of representations].'

The classic doctrine (Port-Royal 1660):

'Tous les mots d'une langue sont autant de signes d'idées . . . ; mais, comme il ne suffit pas que les idées aient leur signes, puisqu'on ne les considère pas isolées et chacune en particulier, et qu'il faut les mettre en rapport les unes à l'égard des autres, pour en former des jugements, on a imaginé des moyens d'en marquer les différents rapports . . . '

This stays unchallenged until the end of the 19th century.

E.g. Hermann Paul (1898) defines 'sentence' as

'the symbol of the fact that
the combining (Verbindung) of several representations or groups of representations has taken place in the mind of the speaker, and the means for generating the aforesaid combination of the aforesaid representations in the mind of the hearer.'

Wundt (1900) attacks Paul:

(1) there may be no time when the word representations are jointly present in our conscious minds;

(2) in the sentence 'Grass is green' our representation of grass already contains our representation of green.

Obvious answer to Wundt's (1): The detailed structure doesn't have to be simultaneously present in consciousness.

Obvious answer to his (2):
There is more than one kind of combination.

Steinthal explains the needed combination as **pattern-matching** (unification!).

I see a blossoming tree.
I match my impression of the tree with my representation of 'tree', creating a combined representation.
I match this combined representation with my representation of 'blossoming'.
It matches, so I say 'The tree is blossoming'.

Christoph Sigwart repeats this almost word for word in his *Logic* (1873).

Brentano (1889): 'Steinthal burns thick clouds of incense on behalf of Sigwart . . .'

Bopp (1820) had suggested that the kind of combination is a form of **concatenation** leaving traces in the verb inflection:

'The present tense, which expresses the real conjunction of a subject with its attribute, without any restriction, is formed in Sanskrit by the mere addition to the root of the characteristics of the person.'

E.g. 'bharami' ('I bear') ends with 'mi' ('me').

Sigwart's *Logic* also repeats Bopp's idea.

As a claim about syntax, Bopp's claim works better for Arabic than it does for Sanskrit.

Gottlob Frege (1848–1925)

(Except where quotes are shown, these are my paraphrases of points that Frege makes many times in different places.)

1. Frege says: Logic is not concerned with individual or national languages, but with objective contents, i.e. (near enough) semantic universals.

Comment: His readers will have read him as distinguishing his logical agenda sharply from the psychological agenda of Lazarus and Steinthal.

2. Frege says: The link between the syntactic structure of a sentence and the structure of its 'objective' meaning exists (else how could we talk?) but is often imperfect.

Comment: This is not an anticipation of deep structures, which are intended to explain the syntactic competence of speakers of a language.

Frege's criterion for the structure of the meaning is that it explains how the sentence figures in valid inferences.

But Frege is original in explicitly moving away from surface structures.

3. Frege says: A compound meaning has fracture lines ('wie er zerfallen könne'). When it is broken at one or more of these lines, the break is asymmetrical; the job of fitting together the parts belongs entirely to one part, the 'unsaturated' part, which requires a fixed number of complements of fixed kinds.

Comment: This is almost pure Port-Royal. Two new features are:
(a) The valency can be greater than two.
(b) At least from the *Grundlagen* (1884) onwards, the meaning can be that of a noun phrase, not just that of a sentence.

15

4. Frege says: If an expression E corresponds to an unsaturated content, the valency information is part of what E means.
In particular a lexical entry for E must indicate this, for example by a notation $E(x, y)$.
The entry must indicate how the meaning of $E(a, b)$ (for any a, b of appropriate type) depends on those of a, b.

Comment 1: In his *Grundgesetze* (1893) Frege spells this out as the rules of definition for different types of expression.
These were new then but are now standard.

Comment 2: In an unpublished paper of about 1880, Frege says

'... in the Begriffsschrift [the designations of properties] never occur on their own, but always in combinations which express contents of possible judgement.'

Here Frege says that in his phrase-markers the entry for a verb explicitly displays its argument places. This is exactly as in Head-driven Phrase Structure Grammar (Pollard and Sag (1994) p. 33):

(14) $\left[\text{LOC}\,|\,\text{CAT}\begin{bmatrix}\text{HEAD} & \boxed{4} \\ \text{SUBCAT} & \langle\ \rangle\end{bmatrix}\right]$ (= S[*fin*])

C   H

$\boxed{1}$ | Kim

$\left[\text{LOC}\,|\,\text{CAT}\begin{bmatrix}\text{HEAD} & \boxed{4} \\ \text{SUBCAT} & \langle\boxed{1}\rangle\end{bmatrix}\right]$ (= *VP*[*fin*])

H C_1 C_2

$\boxed{2}$ $\boxed{3}$
Sandy   Fido

$\left[\text{LOC}\,|\,\text{CAT}\begin{bmatrix}\text{HEAD} & \boxed{4}\,verb[\,fin] \\ \text{SUBCAT} & \langle\boxed{1}\text{NP}[nom]_{[3rd,\,sing]},\ \boxed{2}\text{NP}[acc],\ \boxed{3}\text{NP}[acc]\rangle\end{bmatrix}\right]$

|
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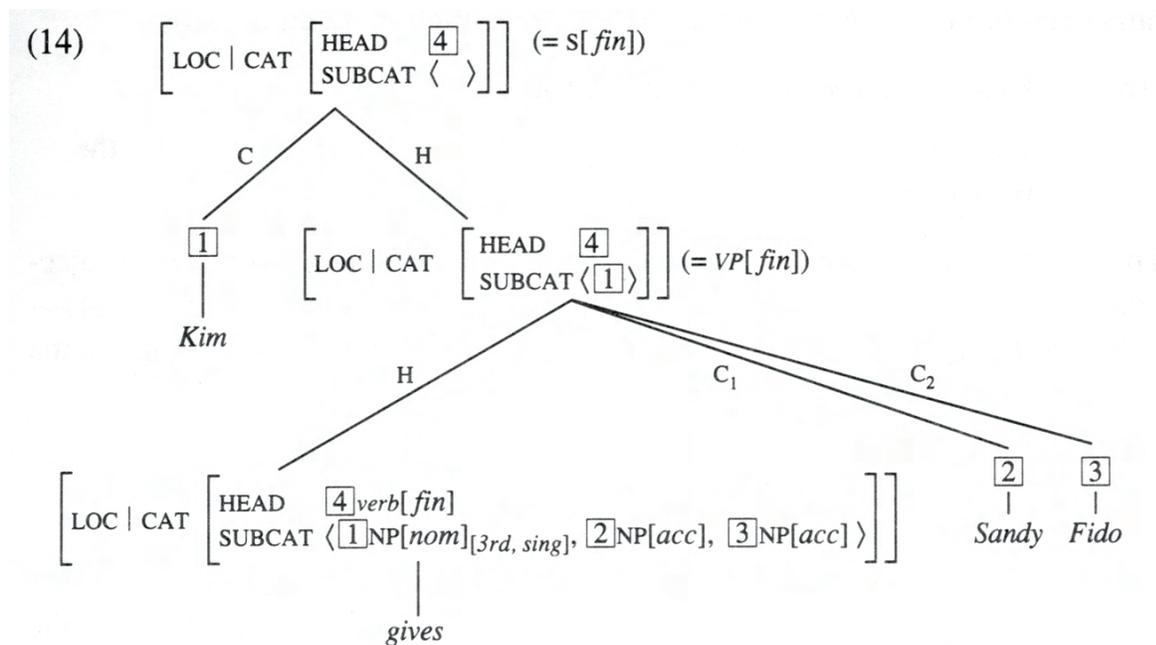
Edmund Husserl (1859–1938)

His *Logische Untersuchungen* (1900) brings together the preceding fifty years, more by cataloguing than by integrating.

But some contributions to linguistics are new, particularly in the fourth Investigation 'The distinction between selfcontained and unselfcontained meanings and the idea of pure grammar'.

- The invention of abstract semantics, catalogued as *Formenlehre der Bedeutungen*.

- The observation that semantic analysis must be well-founded ('kann nicht *in infinitum* fortgehen').

- The observation that the collection of meaningful expressions of a language and that of meaningless ones are both infinite and decidable, and that this calls for an explanation.

- The invention of context-free grammars to explain it.
  (But vaguely. When Ajdukiewicz (1935) tried to make it precise, what he produced was categorial grammars.)

- The invention of substitution frames to define phrase classes in (semantic) grammar.

Roman Jakobson, *Parts and wholes in language* (1960):
'The comparison of incomplete and explicit messages . . . challengingly outlined in Charles Peirce's perusal of "blanks" and in the semiotic studies of Frege and Husserl . . . '