An introduction to phonological representations

EGG 2017, Olomouc
Course outline:

• Class 1: The representation - computation dichotomy in Generative Linguistics

• Class 2: Autosegmental representations in Phonology

• Class 3: The representation of vowels

• Class 4: The representation of vowels II

• Class 5: The representation of consonants
• cognitivism: the world of the thought is real (mind = soul)

• innateness: certain ideas are innate (people are born with them)

• ‘extensity’ (= being describable in terms of dimensions) is the only property of material world

• the only dynamic property of the world is movement (changes in size and shape are all describable by movement)

• What is Descartes greatest invention?
The point $P(2,1.5)$ is located on a grid with $y = 1.5$ and $x = 2$. The diagram shows a coordinate plane with grid lines and labels for the axes.
• **Algebra**: the study of mathematical symbols and the rules for manipulating these symbols

\[(x - a)^2 + (y - b)^2 = r^2\]

• **Euclidean geometry**: a system of axioms describing the properties of mathematical objects

A set of all points that are at a given distance from another point =

= circle
\[(x - a)^2 + (y - b)^2 = r^2\]

\[x = 2\]
\[y = 0\]
\[a = 0\]
\[b = 0\]

\[(2 - 0)^2 + (0 - 0)^2 = 2^2\]
• for quite a long time the phonological statements were formulated like Euklidian geometry definitions:

• ‘Obstruents become voiceless at the end of a word’

• early in the development of Generative Phonology the phonological rules were algebraic

[+obstruent] → [- voice] / __ #
• As Generative Phonology developed, it became **geometric and based on symbols**:

```
root
  / \   / \   / \
lar  → lar / __ #
  |   |   |
  [obstruent] [voice] [obstruent]
```
The representation - computation dichotomy in Generative Linguistics

• the dichotomy between representations and computation is inherent to Generative Linguistics

• Generative Linguistics models operations performed on symbolic representations

• nowadays it is rather clear that a complete theory of phonology call for a complete theory of representations and a complete theory of computation
The representation - computation dichotomy in Generative Linguistics

- the history of phonology in the 20th century shows that this has not always been the case

- Stephen R. Anderson’s book ‘Phonology in the 20th century. ’ takes up the issue of the shift of focus between representations and computation in different schools of phonology in the 20th century
The representation - computation dichotomy in Generative Linguistics
The representation - computation dichotomy in Generative Linguistics

- the book is subtitled ‘Theories of Rules and Theories of Representations’

- ‘Out intent is to study this history [of linguistics] in relation to a particular issue: the balance between rules and representations as components of the theory of language and, more particularly, as components of a theory of sound structure’ (Anderson 1985: 1)
The representation - computation dichotomy in Generative Linguistics

• Structural linguistics (Prague school, American Structuralism):

  • rooted in behavioural psychology: denial of the reality of mental processes/representations

• taxonomic linguistics: the aim of phonology was to assemble **phonemic inventories** of languages

• processes hardly of interest
The representation - computation dichotomy in Generative Linguistics

• early Generative Phonology (Halle 1959, Chomsky and Halle 1968 ‘SPE’)

• representational system based on articulatory features ([+/--back], [+/- continuant] etc.)

• the system was inherently redundant (combinations of [+high] [+low] unattested)

• the representational system was not designed to account for the properties of sound inventories but rather to capture natural classes of sounds that participate in particular sound alternations
The representation - computation dichotomy in Generative Linguistics

• it is the dynamic side of phonology, i.e. sound alternations, that became of main interest

• according to the generative approach to human cognition language is regular, productive and based on symbolic representations (Fodor and Pylyshyn 1988)

• since the regularity and productivity are best visible in the case of phonological alternations (and not e.g. the study of inventories) they became a natural object of study
The representation - computation dichotomy in Generative Linguistics

• the SPE style computation is a computation based on ordered rewrite rules:

  • $A \rightarrow B / \_\_C$

• the order of rules was language specific

• all predictable properties of representations were considered derived (even in the absence of alternation)
The representation - computation dichotomy in Generative Linguistics

- i/n/edible, i/n/explicable, i/n/accurate
- i/ŋ/competent, i/ŋ/convenient, i/ŋ/credible

\[ [+\text{nasal}] \rightarrow [+\text{back}] / \_ \_ [+\text{back}] \]

- lo/ŋ/ - lo/ŋ/er, stro/ŋ/ - stro/ŋ/er

\[ /g/ \rightarrow \emptyset / [+\text{nasal}] \_ \_ \# \]
The representation - computation dichotomy in Generetive Linguistics

- the same rules assumed to apply in non alternating cases: *song*, *among*, *England*, *king kong* etc.

- Happy tensing:

- \( \texttt{I} \rightarrow [+\text{tense}] / \_\_ \# \)

- no contrast between /\texttt{i}/ and /i:/ in the word-final position

- no alternation anywhere in the language

- In general: **whatever can be done by means of processes should be done by means of processing**
The representation - computation dichotomy in Generative Linguistics

• by mid-1970s the researchers did not lose interest in phonological processes but realized that the more complex theory of representations is necessary

• SPE-style representations of segments were matrices of unordered features
The representation - computation dichotomy in Generative Linguistics

Nasal assimilation (Carr 1993: 73):

(28)

\[
\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
+\text{nas} \\
+\text{ant} \\
+\text{cor}
\end{array}
\end{array}
\rightarrow
\begin{array}{c}
\begin{array}{c}
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+\text{ant} \\
-\text{cor}
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The representation - computation dichotomy in Generative Linguistics

• John Goldsmith in his 1976-doctoral dissertation proposed that some features must be assumed to be able to act independently of the rest of the segment.

• Effectively a segment is not a single feature matrix but rather two or more independent matrices associated together.
The representation - computation dichotomy in Generative Linguistics

Goldsmith (1976: 33) representation of the word ‘pin’
The representation - computation dichotomy in Generative Linguistics

• the advanced works on autosegmental phonology went on until the early 1990s

• Sagey (1986) and Clements and Hume (1995) presented full models of feature geometric representations of segments: each feature played the role of an autosegment, i.e. was independent of the rest of the segments

• simultaneously, works were conducted on underspecification theory (Archangeli 1988)

• in general: late 1970s and 1980s witnessed a period of intensive works on the nature of phonological representations
The representation - computation dichotomy in Generative Linguistics

- the extreme representational shift is visible in the off-shoot of Generative Phonology known as Government Phonology (Kaye, Lowestamm and Vergnaud 1990), where no/almost no attention is paid to computation
The representation - computation dichotomy in Generative Linguistics

• the early 1990s brought another shift: in 1993 Alan Prince and Paul Smolensky released their ‘Optimality Theory. Constraint Interaction in Generative Grammar’

• If GP was/is a ‘theory without computation’, OT is an approach that does not stick to any representational approach

• OT is only and exclusively a theory of constraint interaction

• OT is an established theory of computation in current phonological research
The representation - computation dichotomy in Generative Linguistics

- SPE-style computation was based on ordered rules
- an Underlying Representation undergoes all applicable rules
- they were learned
- they were language specific
- they served to form a calculus that allowed to evaluate theories (the fewer rules your analysis employs the better (SPE ch. 8))
The representation - computation dichotomy in Generative Linguistics

• i/n/edible, i/n/explicable, i/n/accurate
• i/ŋ/competent, i/ŋ/convenient, i/ŋ/credible

[+nasal] $\rightarrow$ [+back] / ___ [+back]

• lo/ŋ/ - lo/ŋg/er, stro/ŋ/ - stro/ŋg/er

/g/ $\rightarrow$ $\emptyset$ / [+nasal] __ #
The representation - computation dichotomy in Generative Linguistics

• OT-style computation is based on constraints which ban or enforce certain configurations:
  • *Coda = ‘Do not terminate in a consonant!’
  • Onset = ‘Do not start with a vowel!’

• constraints are innate, they are not learned

• computation is parallel, not serial

• not all constraints are of the same status
The representation - computation dichotomy in Generative Linguistics

- **GENerator**: generates candidates on the basis of the Underlying Representation/Input

- **EVALuation**: candidates are evaluated with respect to how many what constraints they violate

- the candidate that violates the lowest number of the least important constraints wins, i.e. it is the Output

- constraints come in two types: markedness constraints and faithfulness constraints
The representation - computation dichotomy in Generative Linguistics

- **markedness constraints**: ban/enforce certain configurations of features

- **faithfulness constraints**: protect the UR form being changed
The representation - computation dichotomy in Generetive Linguistics

- i/n/edible, i/n/explicable, i/n/accurate
- i/ŋ/competent, i/ŋ/convenient, i/ŋ/credible

AgrPlace;NC: ‘A nasal and a following consonant must share the same place of articulation’

FAITH: ‘Do not change anything’
i/n/+compatible $\rightarrow$ i/η/compatible

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The representation - computation dichotomy in Generative Linguistics

• Identpl; Ons: ‘Do not change the place of articulation of a consonant followed by a vowel’
i/n/+compatible → i/ŋ/compatible

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The representation - computation dichotomy in Generetive Linguistics

• MAX SEG: ‘Do not delete segments’ = ‘A segment in the Input must be in the Output’

• DEP: ‘Do not epenthesize segments’ = ‘A segment absent from the Input cannot be found in the Output’
i/n/+compatible → i/ŋ/compatible

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The representation - computation dichotomy in Generative Linguistics

representation-centeredness  Taxonomic Structural Linguistics

Autosegmental Phonology

Early Generative Approach  Time

computation-centeredness  Optmality Theoretic period