An introduction to phonological representations

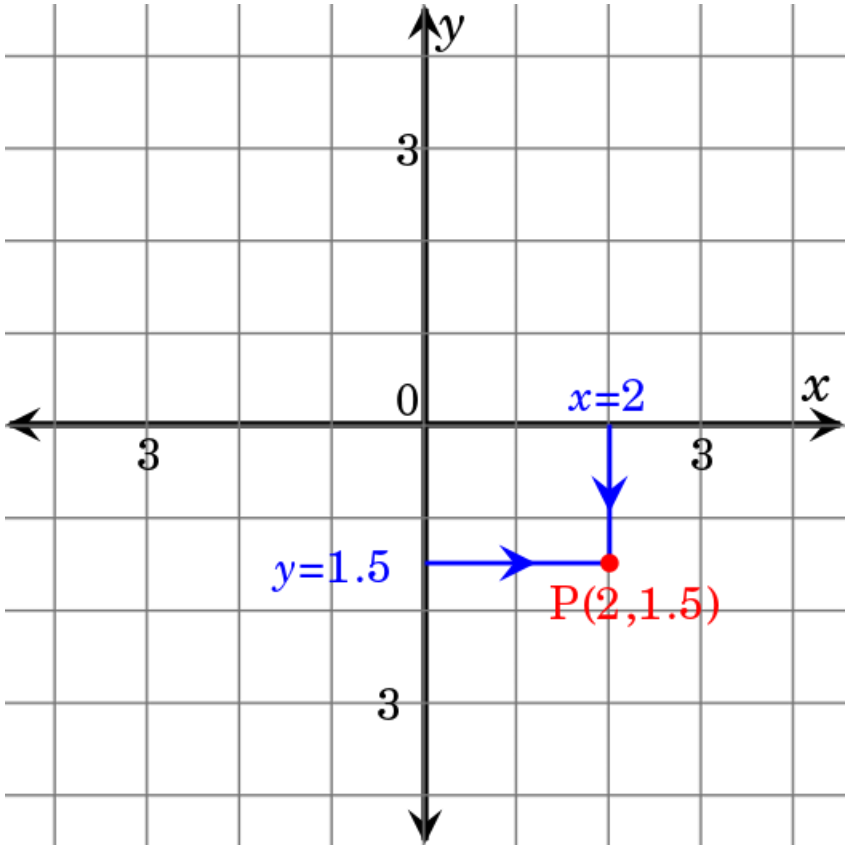
EGG 2017, Olomouc

Course outline:

- Class 1: The representation - computation dichotomy in Generetive 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


RENÉ
DESCARTES

- 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?


y
3
0
x
3
3
x=2
y=1.5
P(2,1.5)
3

- **Algebra**: the study of mathematical symbols and the rules for manipulating these symbols

$(x - a)^2 + (y - b)^2 = r^2$

- **Euklidian 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

$$(x - a)^2 + (y - b)^2 = r^2$$

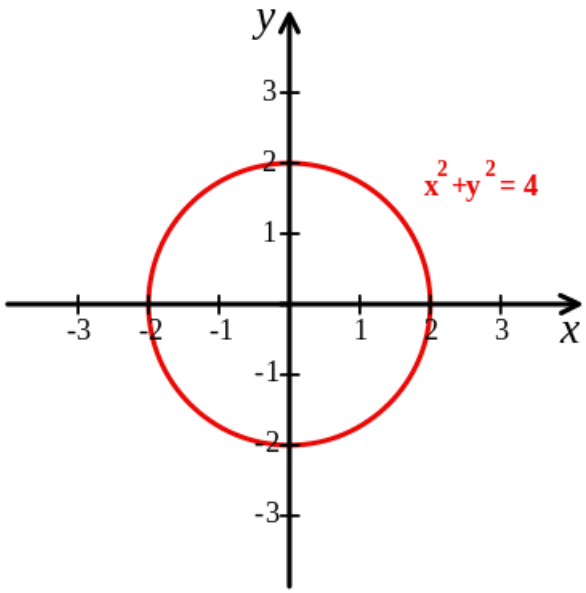
$$x = 2$$

$$y = 0$$

$$a = 0$$

$$b = 0$$

$$(2 - 0)^2 + (0 - 0)^2 = 2^2$$



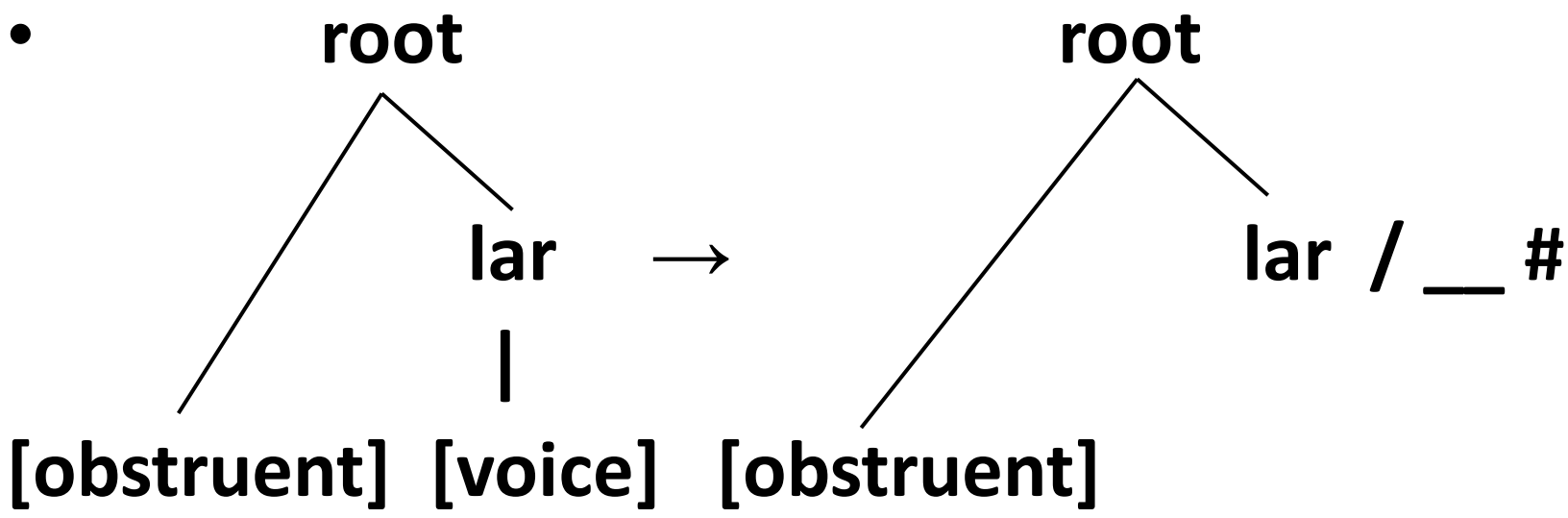
- for quite a long time the phonological statements were fromulated like **Euklidian geometry definitions**:

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

- early in the development of Generative Phonology the phonological rules were **algerbraic**

[+obstruent] → [- voice] / __ #

- As Generative Phonology developed, it became **geometric and based on symbols:**



The representation - computation dichotomy in Generetive Linguistics

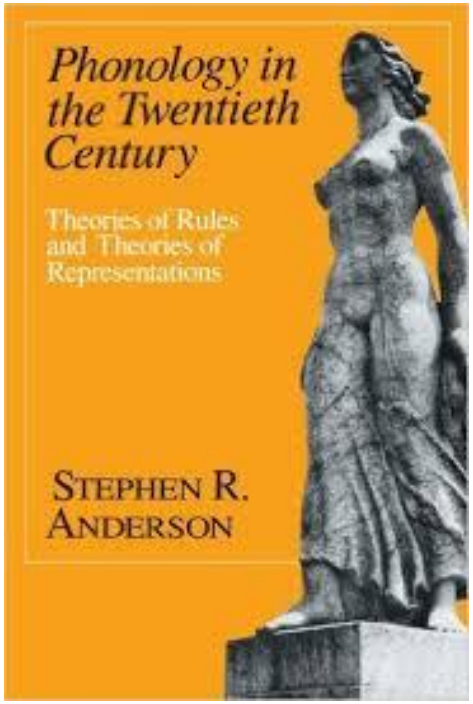
- the dichotomy between representations and computation is inherent to Generative Linguictics
- Generative Linguictics models operartions **performed** on **symbolic representations**
- nowadays it is rather clear that a complete theory of phonology call for a complete **theory of representations** and a complete **theory of computation**

The representation - computation dichotomy in Generetive 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 Generetive Linguistics



The representation - computation dichotomy in Generetive 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 Generetive Linguistics

- Structural linguistics (Prague school, American Structuralism):
- rooted in behavioural psychology: denial of the reality of mental processess/representations
- taxonomic linguistics: the aim of phonology was to assemble **phonemic inventories** of languages
- processess hardly of interest

The representation - computation dichotomy in Generetive 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 Generetive 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 Generetive Linguistics

- the SPE style computation is a computation based on ordered rewrite rules:
- A → 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 Generetive Linguistics

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

[+nasal] → [+back] / __ [+back]

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

/g/ → Ø / [+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:
- ɪ → [+tense] / __ #
- no contrast between /ɪ/ 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 Generetive 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 Generetive Linguistics

Nasal assimilation (Carr 1993: 73):

(28)

$$\begin{bmatrix} +\text{nas} \\ +\text{ant} \\ +\text{cor} \end{bmatrix} \longrightarrow \left\{ \begin{array}{lll} \begin{bmatrix} +\text{ant} \\ -\text{cor} \end{bmatrix} & / \_\_\_\_ & \begin{bmatrix} +\text{obs} \\ -\text{cont} \\ +\text{ant} \\ -\text{cor} \end{bmatrix} \\ \begin{bmatrix} -\text{ant} \\ -\text{cor} \end{bmatrix} & / \_\_\_\_ & \begin{bmatrix} +\text{obs} \\ -\text{cont} \\ -\text{ant} \\ -\text{cor} \end{bmatrix} \end{array} \right\}$$

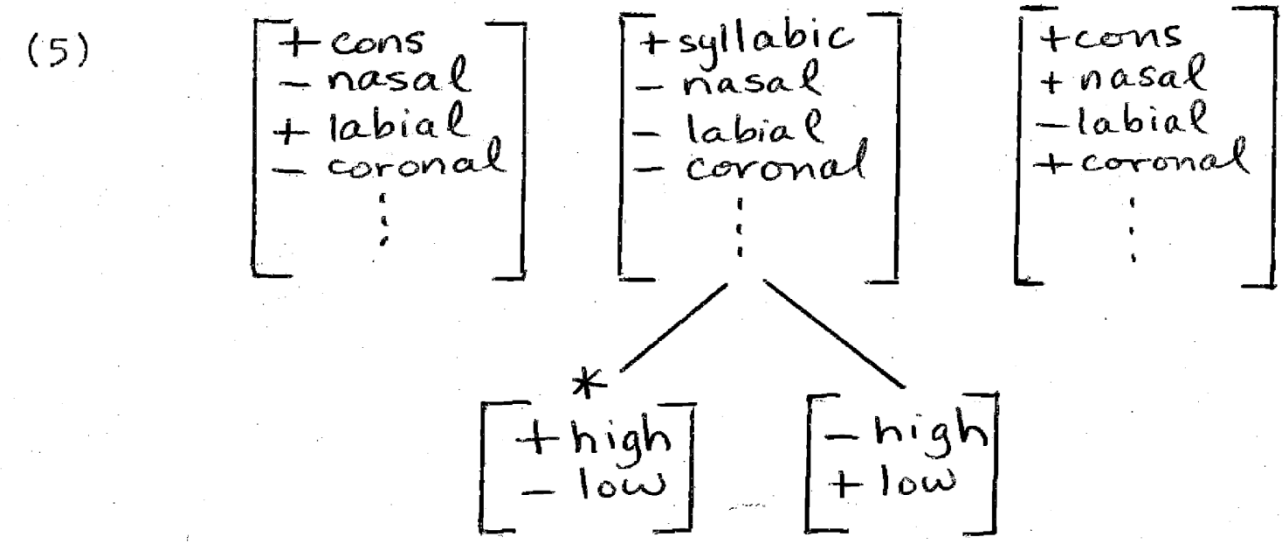
The representation - computation dichotomy in Generetive Linguistics

- 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 Generetive Linguistics

Goldsmith (1976: 33) representation of the word ‘pin’



The representation - computation dichotomy in Generetive 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 wittnessed a period of intensive works on the nature of phonological representations

The representation - computation dichotomy in Generetive 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 Generetive 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 appraoch

- 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 Generetive 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 Generetive Linguistics

- i/n/edible, i/n/explicable, i/n/accurate
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[+nasal] → [+back] / __ [+back]

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

/g/ → Ø / [+nasal] __ #

The representation - computation dichotomy in Generetive Linguistics

- OT-style computation is based on constraints which ban or enforce certain cofingurations:
- *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 Generetive Linguistics

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

- **EVAL**uation: 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 Generetive 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 → i/ŋ/compatible

i/nk/ompatible	**AgrPlace;NC**	**FAITH**
[nk]	*!	
☞[ŋk]		*

The representation - computation dichotomy in Generetive Linguistics

- Identpl; Ons: ‘Do not change the place of articulation of a consonant followed by a vowel’

i/n/+compatible → i/ŋ/compatible

i/nk/ompatible	AgrPlace;NC	Identpl;Ons	FAITH
[nk]	*!		
☞[ŋk]			*
[nt]		*!	*

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

i/nk/ompatible	AgrPlace; NC	Identpl;Ons	DEP	MAX SEG	FAITH
[nk]	*!				
☞[ŋk]					*
[nt]		*!			*
[n]				*	*!
[nək]			*!		*

lo/ng/ → lo/ŋ/

lo/ng/	AgrPlace; NC	Identpl;Ons	DEP	MAX SEG	FAITH
[ng]	*!				
☞[ŋg] 💣					*
[ŋ] ☹				*	*!
[n]				*	*!
[nək]			*!		*

The representation - computation dichotomy in Generetive Linguistics