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Tamás Biró SBL, London, 4 July 2011

## Linguistics as a Model for the Cognitive Approaches in Biblical Studies

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### “Linguistics as a Model for the Cognitive Approaches in Biblical Studies”?

#### 2011: The interaction of three disciplines

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### What Cognitive Science (CS) *is* and *is not* about?

- CS is not about ‘cognition’, in the traditional sense,
  - excluding perception, irrational emotions, behavior, society...
- CS is about ‘cognition’ in the following sense:
  - mental functions of the human brain/mind, which require
  - information processing ability in the brain/mind, hence:
    - computational aspects of CS,
    - biological, psychological, neurological aspects of CS.

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### The cognitive turn in linguistics (1)

- Language viewed as
  - a biological phenomenon,
  - a product of the human brain, *Learnability*
  - which develops in childhood,
  - and evolved as a mental capacity of *Homo sapiens*. *Evolution*

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### The cognitive turn in linguistics (2): An over-simplified history of linguistics

		Linguistics is a tool to...	Language belongs to...
Middle Ages	<i>“Philological” linguistics</i>	...analyze (holy) texts.	... a text or author.
End 18 <sup>th</sup> and 19 <sup>th</sup> century	<i>Historical linguistics</i>	... the history of a nation.	... a nation or people.
1 <sup>st</sup> half of 20 <sup>th</sup> century	<i>Structuralist linguistics</i>	... studying human signs.	... a society.
2 <sup>nd</sup> half of 20 <sup>th</sup> century	<i>Generative linguistics</i>	... studying human brain.	... a brain or a species.

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### The cognitive turn in religious studies: An over-simplified history of Biblical studies

		Bible study is a tool to...	The Bible belongs to...
Middle Ages	<i>Theology</i>	...religious practice.	...the believer.
End 19 <sup>th</sup> and 20 <sup>th</sup> century	<i>Historical approach</i>	... the history of a religion.	... a people or a religion.
2 <sup>nd</sup> half of 20 <sup>th</sup> century	<i>Structuralist and social</i>	... studying communities.	... a society.
1 <sup>st</sup> half of 21 <sup>st</sup> century	<i>Cognitive approaches</i>	... studying human brain.	... a brain or a species.

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### The cognitive turn in linguistics (3)

- Language produced by the human brain *in vivo*:
  - *Psycholinguistics, neurolinguistics.*
- Language produced by the computer *in silico*:
  - *Computational linguistics, language technology.*
- Language as such:
  - *Theoretical linguistics*: combine the best of pre-generative scholarly traditions with the best of cognitive science.

### Parallels in the Cognitive Science of Religion

- Religion produced by the human brain *in vivo*:
  - *Psychology and neurology of religion, experimental CSR.*
- Religion produced by the computer *in silico*:
  - *Comp models.* "CSR technology" supports policy making.
- Religion as such:
  - *Religious studies*: combine the best of pre-cognitive scholarly traditions with the best of cognitive science.

### The cognitive turn in linguistics (4)

- Adopting methodologies from cognitive sciences:
  - Biology-motivated research questions: brain imaging, evolutionary history of language, etc.
  - Formal models:
    - more precise formulations of the theories,
    - such that they can be implemented on computers, analyzed using mathematical tools, etc.

### The cognitive turn in religious studies

- Adopting methodologies from cognitive sciences:
  - Biology-motivated research questions: brain imaging, evolutionary history of religion, etc.
  - Formal models:
    - more precise formulations of the theories,
    - such that they can be implemented on computers, analyzed using mathematical tools, etc.

**HARDLY EXISTING!**  
(as yet)

### Formal models in linguistics: Chomsky

- Structuralist concepts turned into formalism:
- Phrases → phrase structure grammars, syntactic trees.
  - (Binary) distinctive features:
    - Prague school (1930's), Roman Jakobson:
      - For instance: *voiced vs. unvoiced, nasal vs. non-nasal.*
    - Rules in generative phonology (Chomsky & Halle 1968):
      - Word-final devoicing: [+voice] → [-voiced] / \_\_ #
      - Nasal assimilation: [+nasal] → [α place] / \_\_ [α place]

### Formal models in linguistics: Chomsky

- German has word-final devoicing. English does not.
- What is different in the brain/mind of EN vs. DE speakers?
- Rules à la Chomsky & Halle (1968):
  - Phonology of German contains the rule
 
$$[+voice] \rightarrow [-voiced] / \_ \#$$

Applied to /hauz/, and get [haus]. Not applied to /hauz+er/.
  - Phonology of English does not contain this rule: [hauz].
  - Model: different rules in different speakers' brain/mind.

### Formal models in linguistics: Smolensky

- German has word-final devoicing. English does not.
- What is different in the brain/mind of EN vs. DE speakers?
- Constraints à la Prince and Smolensky (1993/2004):
  - Input: /hauz/. Candidates: [haus] and [hauz].
  - Constraints: No\_wordfinal\_voiced; Faithful\_to\_input.
  - English  $H_{EN}$ : Faithful\_to\_input >> No\_wordfinal\_voiced → [hauz]
  - German  $H_{DE}$ : No\_wordfinal\_voiced >> Faithful\_to\_input → [haus]
  - Model: different harmony in different speakers' brain/mind.

### Formal models in linguistics: Smolensky

- Connectionist (neural network) underpinning of
- Optimality Theory (Prince and Smolensky 1993/2004):
    - Set of candidates: forms that occur in languages.
    - Each language L has specific harmony function  $H_L$ .
    - Language L chooses best candidate, with respect to  $H_L$ .
    - Neural networks can optimize such harmony functions.
- Hence, plausible model of the mind/brain.

### The cognitive turn in linguistics: summary

- Why are grammars similar & different?
- Let us understand language in human mind/brain:
  - Bottom-up approach: psycho/neuro-linguistics.
  - Top-down approach: knowledge and methods accumulated by past generations of scholars, developed into formal, computable, but also neurologically plausible models.
- Thereby explain observed phenomena in phonology, morphology, syntax, semantics...

### The cognitive turn in religious studies

- Why are religions similar & different?
- Let us understand religion in human mind/brain:
  - Bottom-up approach: 'psycho/neuro-study' of religion.
  - Top-down approach: knowledge and methods accumulated by past generations of scholars, developed into formal, computable, but also neurologically plausible models.
- Thereby explain observed phenomena: *Bible (its text, history, reception...): such a phenomenon!*

### The cognitive turn in Biblical studies

- Refer to motifs and topics popular in CS or CSR when reading the Bible, or studying its reception.
- View its author/redactor/transmitter/copyist/translator/reader as a *Homo sapiens* with specific mental setup, as known from (or, at least, modeled by) CS and CSR.
- Use the Bible (its text, motifs, history, reception, etc.) as source of data falsifying/corroborating/improving theories in CS and CSR.

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**Thank you for your attention!**

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