Cognitive Neuroscience of Language:

14: Syntax and the normal brain

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Look at how syntax is processed in the brain and assess the claim regarding the autonomy of syntax. Is syntactic processing distinguishable from semantic processing?

Psycholinguistics and the study of syntactic processing

The horse raced past the barn fell
The old man the boats

The study of ambiguity and garden-pathing
Principle-based, constraint-based, exposure-based models
Perception versus production
Listening versus reading …
Psycholinguistics and the study of syntactic processing

General versus dedicated memory resources
The status of different types of information
Independent syntactic output
The N400 effect
Hagoort & Brown (1994)

Distinct from Left Anterior Negativity (LAN) effects
Open/closed class difference?

Brown, Hagoort & ter Keurs (1999)
P600/SPS (Syntactic Positive Shift)
Hagoort & Brown (1994)
P600 and syntactic disambiguation

The sheriff saw the [Indian] and the
The sheriff saw the [Indian], and the

P600/SPS

4µV

Fz

Syntactically unambiguous
Syntactically ambiguous

0 500 1000 1500 2000 (msec)
cowboy noticed the

......
SPS and lexical preferences
Osterhout et al. (1994)

- hoped the patient was lying.
- believed the patient was lying.
- * forced the patient was lying.
- charged the patient was lying.
Syntax and semantics
Hagoort (2003)

Semantic Integration → N400-generator(s) → N400-effect

Interaction?

Syntactic Assignment → P600/SPS-generator(s) → P600/SPS
An N400 boost for combined syntactic and semantic violation
No P600 semantic boost for combined syntactic and semantic violation
Area implicated in morphosyntactic impairment

Dronkers et al. (1998)
PET/fMRI data on normal syntactic processing

Lateral view

- □ Mazoyer et al. (1993)
- △ Stowe et al. (1994)
- ○ Nichelli et al. (1995)
- ■ Stromswold et al. (1996)
- ▲ Just et al. (1996b)
- ● Indefrey et al. (1996)
- ★ Caplan et al. (1998)
Syntactic processing

Indefrey et al. (1998)
Aspects of syntactic processing

Local phrase structure
Identifying noun phrases, ...
frontal operculum, left
IFG anterior, STG

Dependency relations
Cats that dogs chase ....
BA 45 (STM?), LAN

Syntactic integration
... with lexical information; garden paths ...
left posterior STG, P600
Aspects of syntactic processing

Friederici et al. (2006)
Left frontal operculum vs BA 44/45

Friederici et al. (2006)
Conclusions

There is at least some degree of autonomy of representation/processing for syntax.

Brain variation, especially for the higher functions, may be obscuring the situation.