



## Syntactic constructions that Broca's aphasics...

### ... perform at chance on:

- Passives:

*The boy was chased \_ by the girl ...*

- Object relatives:

*The boy who the girl chased \_ ...*

- Object clefts:

*It was the boy who the girl chased \_*

### ... do OK on:

- Actives

*The girl chased the boy.*

- Subject relatives:

*The girl who \_ chased the boy...*

- Subject clefts:

*It was the girl who \_ chased the boy...*

# Trace Deletion Hypothesis (Grodzinsky):

- Broca's area supports chain formation.

*The boy* who the girl chased \_ ...

- Broca's aphasics know how to assign semantic roles to NPs when the NPs are in the "right place" (local to the verb).
- When NPs are moved, their interpretation depends on traces.
- Broca's aphasics' syntactic representations do not have traces.
- Therefore, they apply an Agent-first strategy to moved constituents. When the subject has moved, this strategy works. But when the object has moved, the strategy yields two agents. That's when Broca's aphasics' guess.
  - result is *chance* performance in cases where arguments roles are reversed



## Questions

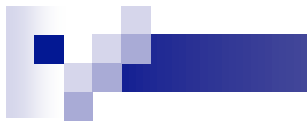
- Is the descriptive generalization that damage to Broca's area causes an impairment in trace interpretation correct?
- Is the TDH hypothesis the right explanation for those patients who do interpret traces at chance?



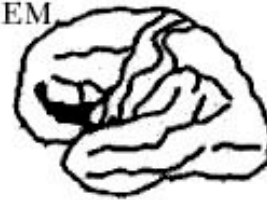
## **Damage to Broca's area → impairment in trace interpretation?**

- **Caplan et al. 1996:**

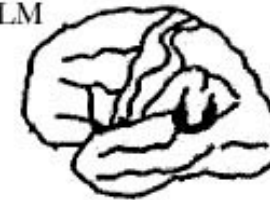
- **Compared 6 patients with purely posterior lesions to 12 patients with both anterior and posterior lesions.**
- **No significant group differences in syntactic performance:** Patients with posterior lesions were as impaired as those with both posterior and anterior lesions on all syntactic operations, including coindexation of traces.



Patient  
EM



Patient  
LM



*Sentence Types*

*Sentences with Full Noun Phrase*

Two-place active	12	12
Three-place active	11	12
Conjoined	9	12
Active Conjoined Theme	10	12
Three Referential expressions	8	12
Simple Referential expression	10	12

*Sentences with Pronouns or Reflexives*

Reflexive, Simple NP subject	8	12
Pronouns, Simple NP subject	9	12
Simple Reflexive, Complex NP subj.	11	12
Simple Pronoun, Complex NP subj.	11	12
Simple Active Reflexive	12	12
Simple Active Pronoun	12	12

*Sentences with Empty Noun Phrases*

Two-place passive	12	12
Truncated Passive	12	12
Two-place Cleft Object	9	12
Three-place passive	9	12
Three-place Cleft Object	2	12
Subject Object Relative	5	7
Object Subject Relative	7	10
Object Object Relative	7	9
Subject Subject Relative	9	12
Passive Conjoined Agent	10	12
Object Control	11	12
Subject Control	6	12
NP-Raising	5	6

**Above  
chance**

Figure 1 (Caplan). Performance (number correct of 12 trials) of patients EM and LM on enactment task (for examples of sentence types, see Caplan et al. 1996)



## Questions

- Is the descriptive generalization that damage to Broca's area causes an impairment in trace interpretation correct?
  - **No.**
- Is the TDH hypothesis the right explanation for those patients who do interpret traces at chance?



**Is the TDH hypothesis the right explanation for those patients who do interpret traces at chance?**

- Do Broca's aphasics represent traces? Or are they just unable to *process* them?
- When trace interpretation fails (for whatever reason), what do Broca's aphasics do (such that chance performance results)?



## **Processing explanation of failed trace interpretation**

- Successful trace interpretation requires:
  - **Representing the trace.**
  - **Being able to reactivate the moved constituent.**
    - Zurif: It's the reactivation that BAs can't do.
    - We know independently that BAs show slower than normal lexical activation.

## Broca's aphasia and crossmodal priming

### *Gap-site, related*

The man liked **the tailor**, with the British accent, who \_ claimed to know the queen.

clothes



### *Gap-site, unrelated*

The man liked **the tailor**, with the British accent, who \_ claimed to know the queen.

weight



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### *Pre-gap-site, related*

The man liked **the tailor**, with the British accent, who \_ claimed to know the queen.

clothes



### *Pre-gap-site, unrelated*

The man liked **the tailor**, with the British accent, who \_ claimed to know the queen.

weight





## **Broca's aphasia and crossmodal priming**

- Normals and Wernicke's aphasics showed priming at the gap site but not at the pregap site.
- Broca's aphasics did not show priming at either.
- Important: No argument reversal in this example.



## **Is the TDH hypothesis the right explanation for those patients who do interpret traces at chance?**

- Do Broca's aphasics represent traces? Or are they just unable to *process* them?
  - **A plausible processing explanation exists.**
- When trace interpretation fails (for whatever reason), what do Broca's aphasics do (such that chance performance results)?



## Do Broca's aphasics represent two agents?

- Chance performance results when BAs are asked to match a stimulus such as

*the boy who the girl chased ...*

either to a picture where a girl chases a boy or to a picture where a boy chases a girl.
- If BA s represent this as involving two agents, would they prefer a picture where both the boy and the girl are chasing?
- Beretta & Munn (1998): NO.



## Too many traces? (Hickok, 1992; Mauner et al 1993)

- VP-internal subject hypothesis.


[<sub>TP</sub>the girl [<sub>VP</sub> \_ chased the boy]]

[the boy who [<sub>TP</sub>the girl [<sub>VP</sub> \_ chased \_]]]

## Too many traces? (Hickok, 1992; Mauener et al 1993)

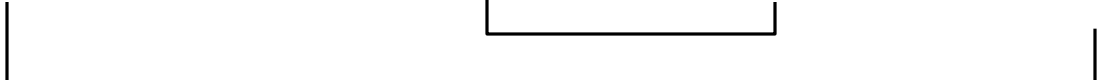
- VP-internal subject hypothesis.

[<sub>TP</sub>the girl [<sub>VP</sub> \_ chased the boy]]



- The boy becomes the chasee because of local role-assignment. The remaining role (chaser) is given to the girl.

[the boy who [<sub>TP</sub>the girl [<sub>VP</sub> \_ chased \_]]]



- Neither argument is local to the verb. BAs guess which one is the chaser and which one the chasee.



## **Is the TDH hypothesis the right explanation for those patients who do interpret traces at chance?**

- Do Broca's aphasics represent traces? Or are they just unable to *process* them?
  - **A plausible processing explanation exists.**
- When trace interpretation fails (for whatever reason), what do Broca's aphasics do (such that chance performance results)?
  - **Evidence against the agent first strategy. Possible that too many dependencies create a confusion.**



# Questions

- Is the descriptive generalization that damage to Broca's area causes an impairment in trace interpretation correct?
  - **No.**
- Is the TDH hypothesis the right explanation for those patients who do interpret traces at chance?
  - **No.**
    - Assuming that BAs have a problem representing traces not a necessary assumption.
    - Picture matching data do not support the agent first strategy.



## Broca's aphasia an syntax more widely

- Broca's aphasia is usually described as a more general syntax problem, involving impaired morphosyntactic comprehension and use of functional morphology.
  - = **“agrammaticism”**



**If you take a group of aphasics and test them on various tests of morphosyntax, what damage is predictive of problems?**

- Dronkers et al. 1994:
  - **Left anterior lobe damage, *not* Broca's.**



# Syntax summary

- While damage to Broca's area often correlates with impaired trace interpretation, traces can be interpreted without Broca's area.
- The functional role of Broca's area remains unclear.
- Overall, evidence for the involvement of left anterior temporal lobe in syntactic processing is stronger.
  - **Is consistently more active for sentences than for word lists.**
  - **Likely generator of (E)LAN.**
  - **Damage to left anterior temporal lobe correlates with morphosyntactic problems.**
- But recall that the left anterior temporal lobe is also activated by various semantic tasks and is the most common locus of cortical abnormality in semantic dementia.