Broca’s aphasics and comprehension

- In the early 1980’s it was discovered that Broca’s aphasics don’t just suffer from impaired production, but also exhibit comprehension problems, especially with more complex syntactic structure.

- A large body of research resulted trying to elucidate the nature of this comprehension deficit and consequently, the role of Broca’s area in syntactic processing.
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 the interpretation of displacement.
  
  \textit{The boy}_{i} \textit{who the girl chased} \textit{t}_{i} \ldots

- Here the object of \textit{chase}, \textit{the boy}, occurs outside the canonical object position.

- The canonical object position is empty. In syntactic theory, it is said to contain a \textit{trace} of the object, which has moved to the beginning of the sentence.

- 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. I.e., they take the first NP to describe the Agent.
Trace Deletion Hypothesis (Grodzinsky)

- When the subject has moved, the Agent-first strategy works (i.e., gives you the right interpretation).

  \[\text{The girl}_i \text{ who } t_i \text{ chased the boy...}\]

  AGENT$^*$ UNDERGOER (occurs in canonical object position)

- But when the object has moved, the strategy yields two agents.

  \[\text{The boy}_i \text{ who the girl chased } t_i \text{ ...}\]

  AGENT$^*$ AGENT (occurs in canonical subject position)

- In the presence of two Agents, Broca's aphasics’ guess which participants is the Agent and which the Undergoer.

  → result is \textit{chance} performance exactly in cases where arguments roles are reversed
Reminder:
Syntactic constructions that Broca’s aphasics...

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... do OK on:
- Actives
  *The girl chased the boy.*
- Subject relatives:
  *The girl who _ chased the boy...*
- Subject clefts:
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Questions

- Is the descriptive generalization that damage to Broca’s area correlates with 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 $\rightarrow$ 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 trace interpretation.
Questions

- Is the descriptive generalization that damage to Broca’s area correlates with 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.
Gap-filling in crossmodal priming

- Prediction of the hypothesis that displacement involves pronunciation at one site an interpretation at another:
  - The interpretation site should be able to, say, prime a semantic relative.
Perform lexical decisions on visually presented targets.

Hear sentence: “The man liked the tailor, with a British accent, who __ claimed to know the queen”

Two factors are manipulated:

(i) Whether or not the visually presented target is semantically related to the displaced element in the auditory stimulus.

(ii) At what point during the auditory stimulus the visual target is presented.
Broca’s aphasia and crossmodal priming

**Gap-site, related**

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

**Gap-site, unrelated**

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

**Pre-gap-site, related**

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

**Pre-gap-site, unrelated**

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

- Target is physically closer to the prime when it occurs at the pre-gap-site.
- But if the prime is in fact reactivated at the gap-site, then the target is closer to the prime at the gap-site.
- No reversal of canonical argument positions in this example; thus the TDH would predict no comprehension problems.
Broca’s aphasia and crossmodal priming

*Gap-site, related*

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

*Gap-site, unrelated*

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

*Pre-gap-site, related*

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

*Pre-gap-site, unrelated*

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

- Normals show priming at the gap-site but not at the pre-gap-site.
- Evidence for reactivation
- Broca’s aphasics do not show priming at either site.
Broca’s aphasia and crossmodal priming

**Gap-site, related**

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

**Gap-site, unrelated**

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

**Pre-gap-site, related**

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

**Pre-gap-site, unrelated**

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

- Zurif: Lack of priming in BA can be explained as a lexical access problem:
  - There is independent evidence that lexical access in BA is slow.
  - Access at a trace site is particularly hard as there is no phonological input.
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.
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 and syntax more widely

- Broca’s aphasia is usually described as a more general syntax problem, involving impaired morphosyntactic comprehension and use of function words.
  - = “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.
Agrammaticism crosslinguistically

- In English it is possible to utter uninflected word forms (go, run, see) and drop function words and this is what agrammatic aphasics often do.

- But in some languages you just cannot utter bare stems. What’s aphasic speech like in those languages?
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*Note.* KTV, write.
Hebrew agrammaticism

- Friedman and Grodzinsky (1997):
  - Hebrew speaking agrammatic aphasic (RS) with left anterior temporal lobe damage.
  - Tense errors in production but not in comprehension.
  - Errors never involve creating a nonword.

The input route of RS seems to be relatively spared as she was able to detect very easily the same errors she herself had made, once read aloud to her (in addition to her good results in the tests). In this respect, many agrammatistics are similar to jigsaw puzzle players: when asked to fill in a blank without a well-defined set of alternatives (or with too many possible parts), they are lost, unable to make the right choice. Yet once a piece is in their hands, they know exactly whether or not it fits.
Syntax summary

- The functional role of Broca’s area remains unclear.
  - Broca’s area certainly relevant for syntax but it’s not likely to “perform” syntax.

- 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.
  - Damage to left anterior temporal lobe correlates with morphosyntactic problems.