We’re Talking Stressed
A Domain-General Approach to Language Disorders

Overview
- review of localizationist models of aphasia
- domain-general approaches
- implications
- evidence from normals under stress

The Modular Perspective

The Past Tense Debate
The Dual Route Model
- irregulars (‘go’ → ‘went’)
  - association (lexicon)
- regulars (‘walk’ → ‘walked’)
  - rule (grammar)

Pinker (1999); Pinker & Ullman (2002); Ullman et al. (2005)

Aphasic Deficits
Broca’s Aphasia
- inferior frontal lesions
  - nonfluent speech
  - good comprehension
  - grammatical deficit
Wernicke’s Aphasia
- posterior temporal lesions
  - fluent speech
  - poor comprehension
  - lexical-semantic deficit

Grammar in Broca’s Aphasia
production of morphology and complex sentences
omission/substitution of grammatical morphemes,
avoidance of passives
sentence-picture matching
(Caramazza & Zurif, 1976; Caplan et al., 1985; cf. Caplan, 1992)
errors on passives and embedded clauses
morphological priming
absence of priming for morphological agreement
past tense generation/reading
(Ullman et al., 1997a,b)
errors on regular past tense forms
Lexical-Semantics in Wernicke’s Aphasia

- spoken word production and picture naming
- semantic paraphasias, word-finding difficulties
- word-picture matching (Goodglass & Baker, 1976)
- selection of semantic foils
- semantic clustering (Zurif et al., 1974)
- failure to show normal category structure
- relatedness judgments (Milberg & Blumstein, 1981)
- unable to indicate whether two words are related

Grammaticality Judgments

- Broca’s are better than chance
- Wernicke’s aren’t

Does this make sense?

- ‘How many did you see birds in the park?’ ×
- ‘Is the boy having a good time?’ ✓
- ‘John is very tall, doesn’t he?’ ×
- ‘He came my house ten o’clock.’ ×
- ‘She went up the stairs in a hurry.’ ✓

Linebarger, Schwartz, & Saffran (1983)

‘Whodunit?’ Task

<table>
<thead>
<tr>
<th>Active Subject Cleft</th>
<th>Passive Object Cleft</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘The dog is hitting the cat’</td>
<td>‘The cat is hit by the dog’</td>
</tr>
<tr>
<td>‘It’s the dog that is hitting the cat’</td>
<td>‘It’s the cat that is hit by the dog’</td>
</tr>
</tbody>
</table>

Semantic Priming

- Wernicke’s show reliable priming
- Broca’s don’t

Pairing:

- PRIME: war cat (ring)
- TARGET: peace peace (gliarf)

List:

- CAT ... STOVE ... BLICK ... WAR ... PEACE ...
- FENT ... JUDGE

(Milberg & Blumstein, 1981; Blumstein, 1997)

Semantic Priming

- CONTROLS: more related pairs = larger priming effect (strategic processing)
- WERNICKE’S: no relatedness proportion effect
- BROCA’S: increased relatedness proportion effect

Domain-General Performance Deficits

Broca’s
- impaired facilitation
- spared judgments
- spared strategies
- impaired automatic/implicit processing

Wernicke’s
- spared facilitation
- impaired judgments
- impaired strategies
- impaired controlled/strategic processing

( Aydelott Utman, Blumstein, & Burton, 2001; Blumstein, 1997; Milberg, Blumstein, Katz, Gershberg, & Brown, 1995)

Rhyme Priming

Milberg, Blumstein, & Dworetzky (1988)

Behavioural Priming Effects

- facilitation
  - activation of congruent targets
  - rapid, ‘automatic’
  - low attentional/processing demand
  - sensitive to acoustic variation
  - Andruski et al., 1994; Aydelott Utman et al., 2001; Marslen-Wilson, 1993; Neely, 1991; Simpson, 1994; Stanovich & West, 1983

- inhibition
  - suppression/inhibition of incongruent targets
  - slow, ‘controlled’
  - high attentional/processing demand
  - Gernsbacher, 1996, 1997; Stanovich & West, 1983; Simpson, 1994; Dagenbach & Carr, 1994

Implications

- aspects of language processing that are disrupted in aphasia should be vulnerable to domain-general cognitive stress
- possible to induce aphasic profiles in normal individuals

Sentence Priming Paradigm

Biasing Context: On a windy day, it’s fun to go out and fly a

Neutral Context: Its name is

Target

<table>
<thead>
<tr>
<th>Congruent</th>
<th>Incongruent</th>
<th>(Nonword)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KITE</td>
<td>TABLE</td>
<td>(GLARF)</td>
</tr>
</tbody>
</table>
Acoustic Distortion

distortion affecting **intelligibility**
- low-pass filtering, high-frequency noise
  - (Stuart & Phillips, 1996)
  - reduced spectral information
  - decreased perceptibility of phonetic contrasts

distortion affecting **processing**
- increased speaking rate, competing speech
  - (Sommers, 1997; Gordon-Salant & Fitzgibbons, 1993, 1995)
  - decreased processing time
  - increased processing demand

Vulnerability of Lexical Processes

facilitation
- rapid, ‘automatic’
- sensitive to quality of sensory input
- low attentional/processing demand
  ➔ **perceptual degradation**

inhibition
- slow, ‘controlled’
- high attentional/processing demand
  ➔ **reduced time/increased demand**

Predictions

reduced **intelligibility**
- (filtering/noise)
  ➔ reduced activation
  ➔ less facilitation
  ➔ less inhibition?

less time/more demand
- (rapid/competing speech)
  ➔ reduced suppression
  ➔ less inhibition

Sentence Priming Paradigm with Acoustic Distortion

**Biasing Context**
- On a windy day, it’s fun to go out and fly a

**Neutral Context**
- Its name is

**Target**

<table>
<thead>
<tr>
<th>Congruent</th>
<th>Incongruent</th>
<th>(Nonword)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KITE</td>
<td>TABLE</td>
<td>(GLARF)</td>
</tr>
</tbody>
</table>

**TASK:** Is the target a real word? YES/NO

Reduced Intelligibility (Filtering)

- **Unaltered**
- **Altered**

Reduced Processing Time (Fast Rate)

Summary

- acoustic distortion reduces contextual priming effect
  - distortions that reduce intelligibility reduce facilitation (& inhibition)
  - distortions that reduce processing time reduce inhibition only
    → lexical processes partially separable

A Special Case: Competing Speech

- perceptual masking
- increased attentional demand
- conflicting semantic content

Implications

- reduced intelligibility
  → reduced facilitation & inhibition
- increased attentional demand
  → reduced inhibition

Sentence Priming Paradigm with Competing Speech

- He wanted to come in, but she refused to open the
- The next item is isolation or competing speech

- TASK: Is the target a real word?

Competing Signal Conditions

- isolation (no competing signal)
- forward speech (different ear)
- backward speech (different ear)
  - similar acoustic properties
  - no semantic content
- forward speech (same ear)
  - spectral masking
  - reduced intelligibility
**Predictions**

- **same ear** speech  
  - reduced *facilitation* & *inhibition*
- **different ear** speech  
  - reduced *inhibition*  
  - semantic content? *(forward vs backward speech)*

**Forward Competing Speech**

- No Competing Signal
- Forward Speech (Different Ear)

**Backward Competing Speech**

- No Competing Signal
- Backward Speech (Different Ear)

**Forward Speech (Same Ear)**

- No Competing Signal
- Forward Speech (Same Ear)

---

**Summary**

*competing signal modulates contextual priming effect*

- **forward speech** reduces *inhibition*  
  - increased attentional demand
- **backward speech** has *no effect*  
  - demand depends on semantic content
- **forward speech presented to same ear** reduces *facilitation*  
  - reduced intelligibility

*Moll, Cardillo, & Aydelott Utman (2001)*

---

**‘Whodunit’ Task with Perceptual Stress**

**TASK:** 'Who is doing the action?'

- ‘Cat.’ ‘Dog.’

- *intact* or *distorted*  
  - intact

**Active**

<table>
<thead>
<tr>
<th>Subject Cleft</th>
<th>Passive</th>
<th>Object Cleft</th>
</tr>
</thead>
</table>
| ‘The dog is hitting the cat’ | ‘It’s the dog that is hitting the cat’ | ‘The cat is hit by the dog’ | ‘It’s the cat that is hit by the dog’

*Moll, Cardillo, & Aydelott Utman (2001)*
**‘Whodunit’ Task with Perceptual Stress**

- healthy young adults listening to degraded speech show poorer performance on complex sentence types

**‘Whodunit’ Task with Competing Speech**

Leach, Aydelott, Symons, Carnevale, & Dick (in press)

**Verbal and Nonverbal Comprehension in Aphasia**

- related distractor
  - verbal cue: ‘cow mooing’ [spoken words]
  - non-verbal cue: ‘moo-oo!’ [cow sound]

- unrelated distractor

**Conclusions**

- apparent ‘language-specific’ deficits may result from **domain-general disturbances**
- normal language comprehension may be selectively vulnerable to **general cognitive stress**