Inaccessible or Unstable? Further Applications of the IA Model

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Thanks to…

Caroline Fisher

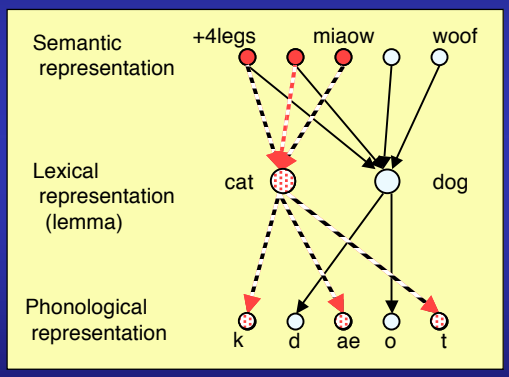
Leonie Keall

Liz Stuart

Royal Society of New Zealand

Types of Impairments in the IA Model

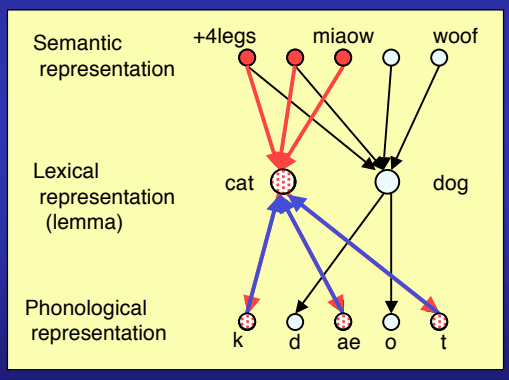
- Dell et al (2003); Foygel and Dell (2000): weakened S->L and/or L->P connections
- Result = reduced/slowed transmission of activation
  - –Weakened S->L connections: lexical nodes under activated, so can't access correct word
  - –Weakened L->P connections: phonological nodes underactivated, so can't access correct phonemes



Types of Impairments in the IA Model

BUT an alternative type of impairment is possible….

- Martin, Dell, Saffran & Schwartz (1994): Increased *decay rate* of nodes
- Consequently, representations are "accessed" but activation not *stable* over time
- Predicts different error patterns: stronger influence of feedback = more *formal paraphasias*



"Decay" Impairments

- Martin et al (1994): *Global* increase in decay rate (*all* nodes affected)
- Produces *Deep dysphasia*:
  - Frequent formal paraphasias in naming and speech
  - Can't do tasks requiring *maintenance of activation:*
    - word repetition (semantic and other errors)
    - nonword reptition
    - short-term memory
- This idea of "unstable" or "fast fading" info not new (e.g. Michel & Andreewsky, 1983)
- BUT, IA model provides a formal framework for describing this idea.

"Decay" Impairments

- Later work: group study varied *global* decay impairments and *global* connection strengths (Dell, Schwartz, Martin, Saffran & Gagnon,1997).
- Variation in these two parameters explains some differences between individuals, but not as many as S-P model

Our Research

- Perhaps we need to consider both dimensions:
  - Not only *locus* of impairment (lexical or phonological)
  - But also *nature* of impairment (weak connections or decay)
- Two fluent aphasic individuals: MS and GE
- For both, phonemic paraphasias are main error type in naming
  - i.e. both have same *locus* of impairment
- BUT performance of the two differs qualitatively, suggesting *nature* of impairment is different.

Case Descriptions

Patient MS

- CVA; small lesion in left posterior parietal lobe; 12 months post stroke
- Speech is well-articulated, grammatical, but many phonological errors
- Comprehension impaired
- Can't repeat words/sentences, zero performance on nonwords repetition
- BDAE: Borderline Wernicke's/Conduction Aphasia

Patient GE

- CVA; moderately large lesion in left parietal lobe; 4 months post stroke
- Speech well-articulated, grammatical but hesitant; many phonological errors
- Comprehension preserved
- BDAE: Conduction Aphasia

Performance in Naming and Repetition

	Naming		Repetition	
Response type[a]	MS	GE	MS	GE
Correct	47.3	21.7	30.1	55.6
Phonemic paraphasia	19.5	33.3	34.7	31.1
Formal paraphasia	13.6	7.2	14.5	4.4
Semantic paraphasia	4.7	5.6	0.6	0
Unrelated word	6.5	7.2	3.5	0.6
Neologism	4.1	12.2	7.5	0.6
Other	4.2	12.8	9.2	8.0
Word Length Effects	*no*	*yes*	*no*	*yes*
Word Frequency Effects	*yes*	*yes*	*no*	*no*

Auditory Comprehension

Patient MS:

- –Phoneme discrimination (e.g. *cub- cut*) : 75%
- –Auditory lexical decision: 79%; missed many *real* words
- –Word-picture matching with semantic distractors (e.g *crab-octopus*) 100%
- –Word-pic matching with with phonological distractors (e.g. *comb-cone*) 58%

Patient GE:

- –Phoneme discrimination (e.g. *cub- cut*): 85%
- –Auditory lexical decision: 85%
- –Word-picture matching with semantic distractors (e.g *crab-octopus*) 94%
- –Word-pic matching with with phonological distractors (e.g. *comb-cone*) 80%

Summary

- Both patients produce phonemic paraphasias as main error type

  -> can't correctly access phoneme nodes

- BUT

PATIENT MS	PATIENT GE
Many formal paraphasias	Few formal paraphasias
Repetition << naming	Repetition > naming
No length effects are weak	Strong length effects
Phonological input processing esp. poor	Phonol. input processing still weak, but better than MS

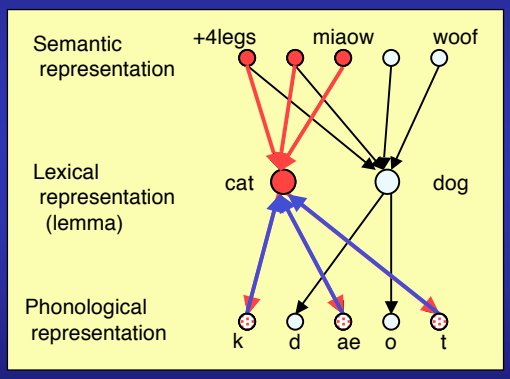
The Phonological "Decay" Hypothesis

These differences suggest:

- Problem at same locus, but nature is different

Our hypothesis:

- GE = weak L->P connections
- MS = fast decay in *phonological* nodes



Predicts

- MS's will produce a high rate of formal paraphasias
- MS will perform poorly on tasks requiring maintenance of phonological information, such as word (and especially nonword) repetition
- If network is used in both production AND comprehension, then MS will also have comprehension difficulties (fast decay means fast "fading" of phonological input)

Conclusion

- One type of impairment - weak connections - not enough to capture actual differences between cases
- An ideal model of aphasic word production needs to consider both "accessibility" and "stability" of linguistic information
- IA model provides ideal framework for describing *dynamic* impairments such as this