MODELLING THE RELATION BETWEEN GESTURE AND SPEECH IN APHASIA

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Two ways in which gesture and aphasia research can benefit from each other:

a) Gesture research helping aphasia research
   - Theories & Therapies

b) Aphasia research helping gesture research
   - Providing new challenges

This talk will be mainly about b)
Gesture models are created to explain certain psycholinguistic phenomena:
- Semantic ‘synchrony’
- Temporal synchrony
- ...

Surprise: these models are usually able to explain the phenomena that motivated them.
From a strictly scientific perspective, this is not sufficient.

A model that can only explain what it was devised to explain is just a theory dressed up as a model.

Real models can predict or explain phenomena that were *not their primary motivation*.
Model tests in gesture research:
- Stuttering (Mayberry & Jaques 2000)
- Dysfluencies (Seyfeddinipur 2006)

Another candidate: Aphasia
We have been looking at individuals with “nonfluent aphasia”:
- dysfluent speech production
  - reduced phrase length
  - pauses
- perception less affected than production
- coherent communicative intention, generally achieved

We focus on iconic gestures (or equivalent)
The central phenomena

- Relative to healthy controls:
  - The speech and gesture rate are reduced
  - but the gesture/word ratio is higher
McNeill’s (1992) “Growth Point” theory

- Not a real computational model
- Kendon: “The Growth Point is a poetic notion”

Key assumptions

- Gesture is not “nonverbal behavior” but is intricately linked to speech (McNeill 1985)
- Gesture and speech have the same representational origin
- A GP represents one information unit that is (somehow) expanded into both gesture and speech
MODELS

- Butterworth & Hadar (1989)
  - Response to McNeill (1985)
- Assumptions:
  - Gestures not primarily communicative
  - Function: to internally facilitate speech production
GENEALOLOGY OF GESTURE MODELS

Lexical access theory

- Hadar & Butterworth 1989
- Krauss et al. 2000

Nonverbal Behavior Research

- De Ruiter 2000
- Kita & Özyürek 2003

Growth point theory

- McNeill 1985

- Krauss et al. 2000
- De Ruiter 2000
- Kita & Özyürek 2003
Comparison of Sketch Model (De Ruiter 2000) and Interface Model (Kita & Özyürek 2003)

- **Same**: assume that Levelt’s *conceptualiser* splits communicative intention into two modalities (verbal clause & gesture component)

- **Different**:  
  - how gesture and speech are semantically aligned  
  - whether gesture is generated from pre-existing action schemata (Interface) or from imagery (Sketch)  
  - Types of gestures incorporated
Sketch model

- Gesture and speech are aligned by conceptualiser
- For that, conceptualiser needs to “know” about language (cf. Levelt et al. 1999)

Interface model

- Action generator, message generator, and formulator exchange information to incrementally adapt gesture to planned speech
Repeating central finding

- In nonfluent aphasia:
  - The speech and (iconic) gesture rate are reduced
  - The (iconic) gesture/word ratio is higher
Lexical facilitation explanation:

- In nonfluent aphasia, there frequently are word finding problems.
- To compensate, individuals diagnosed with aphasia produce more gestures.
Our new “Growth Point family” explanation:

- Due to fluency problems, conceptualiser adapts by producing smaller units (cf. Kolk & Heeschen 1990)
  - If there is one gesture per unit, and the number of words goes down, the number of gestures per word goes up.
- Sometimes, gesture is used to compensate for communication deficits in speech
  - These are often speech-replacing gestures (to the right of “Kendon’s continuum”) or interactive gestures
Both model types can accommodate the aphasia findings

The explanations are very different

It depends on what model (family) one believes in
I prefer the GP type explanation because

- It is compatible with the Adaptation Hypothesis (Kolk & Heeschen 1990;)
- Controlled experiments have shown that making gestures does not help in resolving TOT states (Frick-Horbury & Guttentag 1998; Beattie & Coughlan 1999)
- But perhaps TOT states are not comparable to aphasia-related fluency problems
We should always test models on new phenomena.

Aphasia research provides gesture researchers with these phenomena.

There are two “families” of gesture models:
- Growth point based
- Lexical facilitiation based

Both model types can accommodate the increased iconic gesture/word rate.

Clearly, further research is necessary:
- Different gesture types
- Different contexts
- Different tasks