



CITY UNIVERSITY  
LONDON

# Aphasia and Gesture

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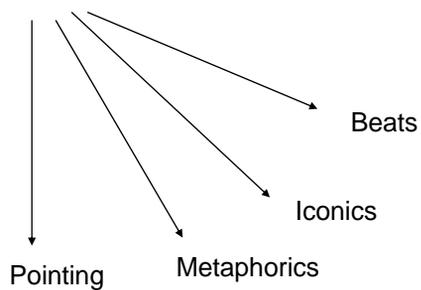
## Overview

- Types of gesture
- Why do we gesture?
- A model of gesture production
- Gesture in aphasia
- Gesture therapy
  - To support word retrieval
  - As a compensatory modality



## What is Gesture? The Kendon Continuum

Gesticulation → Pantomime → Emblems → Sign Language



## Gesture is Universal (Kita, 2009)



# Why do we gesture?

## The Communication Hypothesis

Gestures help us to get our message across

- When Speech cannot be heard
- In collaboration with speech
  - 'I contacted him' (+ texting gesture)

(Kendon 2000, McNeill 2005)

## Counter views

- People gesture when they cannot be seen, eg on the telephone
- Blind people gesture, even when speaking to each other (Iverson and Goldin-Meadow 1998)

**Gestures may be produced for the sake of the speaker as well as the listener.**

## The Lexical Retrieval Hypothesis (Krauss et al 2000)

Gestures help us to access words

- More gestures are seen in spontaneous than rehearsed speech (Chawla and Krauss 1994)
- Inhibiting gesture
  - Raises failure rates in naming to definition tasks
    - (Frick-Horbury and Guttentag 1998)
  - Decreases TOT resolutions
    - (Beattie and Coughlan 1999)

Note that this evidence is not conclusive

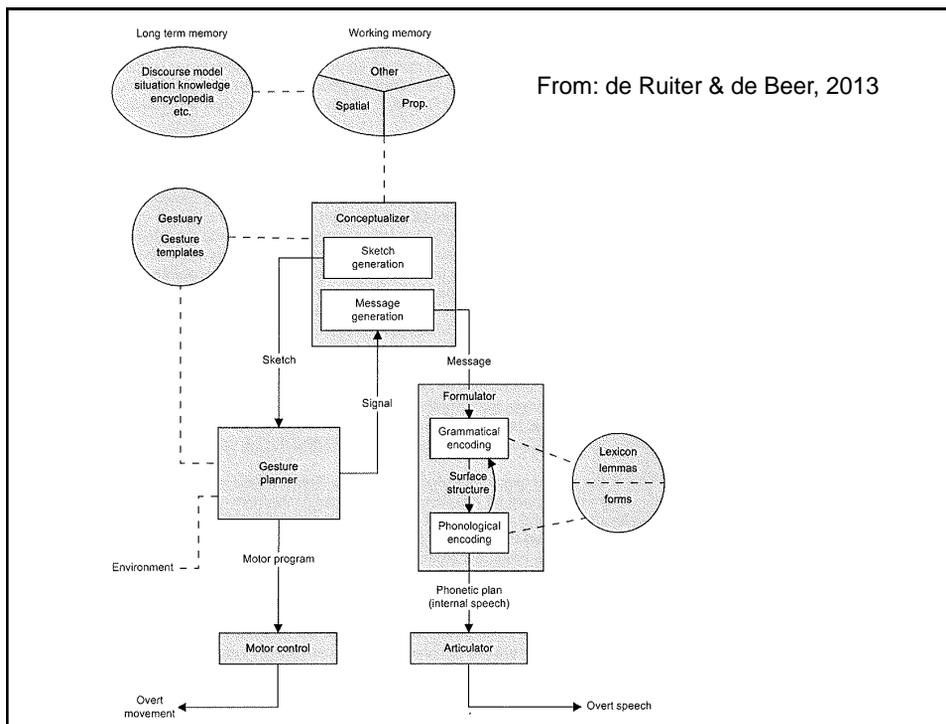
## The Information Packaging Hypothesis (Kita 2000)

- Gestures help us to frame thoughts for language
- Evidence:
  - Speakers gesture more when the conceptual demands of the task increase (Hostetter, Alibali and Kita 2007)
  - Gestures reflect the properties of the speaker's language (Kita & Ozyurek, 2003)

## Interim Summary and Implications for Aphasia

- Gestures have external (communicative) and internal (speaker) functions
- All hypotheses suggest that gesture can play a useful role in aphasia therapy
  - To assist communication
  - To support word retrieval
  - To help frame thoughts for language

# A Model of Gesture Production



## Implications of the model

- Gesture and speech arise from a common communicative intention
- They collaborate to convey that intention
- Separate pathways allow for dissociations between speech and gesture, e.g. Following brain damage
- Gesture can compensate for difficulties in the formulator and articulator ('Trade off')

## Gesture in Aphasia

## Is Gesture Available in Aphasia?

Yes:

- There are single cases in which gesture > language  
(Marshall et al 2004; Kemmerer et al, 2007)
- Gesture supplements discourse in aphasia  
(Pritchard et al, 2015; Sekine et al, 2013; Sekine & Rose, 2013)
- Gestures accompany aphasic word finding blocks  
(Cocks et al, 2010; Lanyon & Rose, 2009)
- Gestures support aphasic conversation  
(e.g. Wilkinson et al 2010)
- Gestures are used by people with severe aphasia  
(Goodwin 1995; Parr 2007)

### An Example from 'Terry' (Parr 2007)

- I ask what he will do today and he shrugs and then makes a pulling movement with his hands and points to the window. 'Over there'. I think for a minute. 'Fishing?' No. He makes a repetitive side to side movement with his hands and points out of the window: 'That'. The hedge is waving wildly and I say: 'Trim the hedge?' and he says 'That's it that's it' .. What will he have for lunch? He mimes a chicken by tucking his hands into his armpits, raising and lowering his elbows and clucking. 'Chicken?' 'That's it' ... He points to Jane's chair and says: 'Him' 'Something Jane has left for you?' 'Yes'.

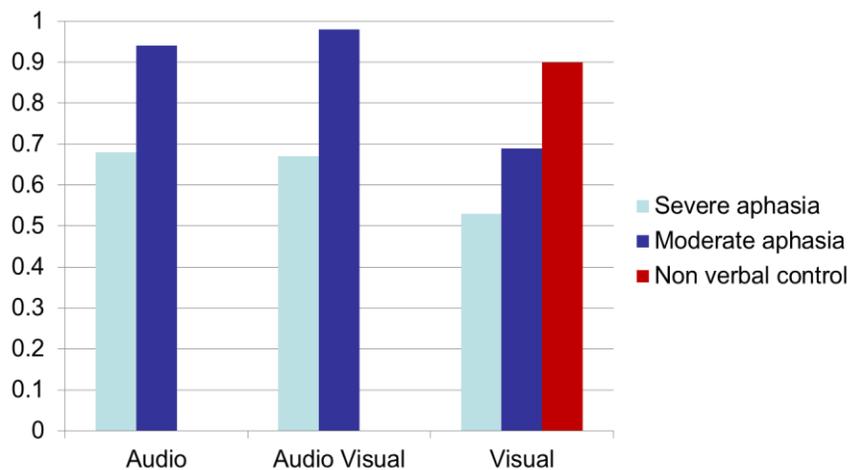
## Is gesture always available in aphasia?

- In formal gesture elicitation tasks people with aphasia typically score below healthy and RH controls
  - (e.g. Goldenberg et al, 2003; Wang & Goodglass, 1992)
- Tasks requiring both the production and comprehension of gesture may be impaired; and gesture scores may relate to language scores
  - (e.g. Duffy and Duffy, 1981; Duffy & Watkins, 1984)

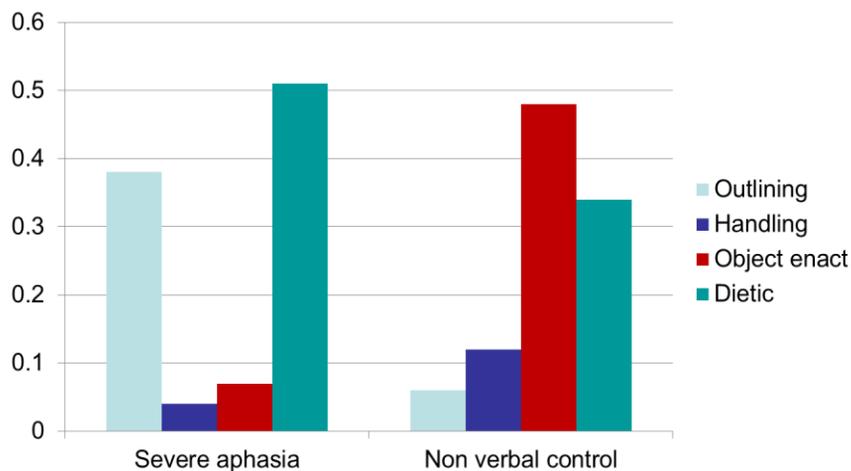
## Mol et al, 2013

- 25 people with aphasia
- 17 non aphasic controls
- Communicate two scenarios
  - Buying a sweater
  - A road accident
- Scores:
  - Comprehension of dialogues by raters, across different conditions
  - Gesture coding

### Proportion of dialogues understood by raters in each condition (Mol et al, 2013)



### Gesture types: Accident dialogue (Mol et al, 2013)



## Interim summary

- Gesture skills may outstrip language skills in aphasia; and gesture is often used to support communication
- However:
  - Skills with gesture cannot be assumed
  - Performance on gesture tasks may be impaired relative to controls
  - Some people with aphasia do not exploit the full potential of gesture

## Predictors of Skill with Gesture: Speech Fluency

- Fluent aphasia associated with 'empty' gestures (such as beats)
- Non fluent aphasia associated with semantically rich gestures, such as iconic, pantomime and emblem gestures
- Non fluent speakers produce more gestures per word than fluent speakers  
(e.g. Cicone et al, 1979; Le May et al, 1988; Sekine et al, 2013)

## Predictors of Skill with Gesture: Semantic Skills

- Hogrefe et al (2012)
- 24 people with aphasia
  - Aachen Aphasia Test
  - Non verbal Assessments of semantic processing
  - Apraxia Tests
  - Retelling of video clips
- Semantic (but not language) tests predict formal diversity of co-speech gestures

## Predictors of Skills with Gesture: Apraxia

Apraxia scores do not relate to the number of gestures used in conversation (Rose & Douglas, 2003)

But apraxia may predict gesture *quality*:

Participants who scored best on tests of apraxia made the most effective use of gesture (Mol et al, 2013)

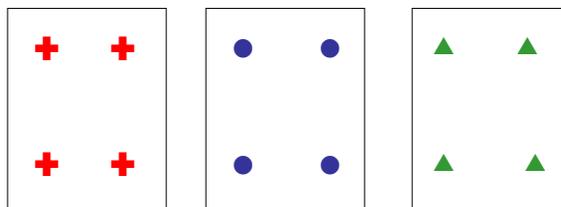
Apraxia scores predict whether gestures are informative to observers (Hogrefe et al, 2012)

## Predictors of Skill: Executive Function

Purdy and Koch 2006

- 15 people with aphasia tested on:
  - PICA Language Test
  - Wisconsin Card Sorting Test
  - CADL (cognitive flexibility score)
- Referential communication task
  - Convey 15 action pictures to a partner
  - Opportunity to use trained gestures/symbols

## Wisconsin Card Sorting Test



Executive task: sort by one criteria (eg colour);  
then switch to a different criteria (eg symbol)

Requires ability to retain then switch sorting  
criteria

## Main Findings

- WCST and Cognitive flexibility score predict performance on the referential task
  - Use of trained gestures and symbols
  - Switches between modalities
- PICA does not predict performance
- Cognitive and Executive skills are better predictors of strategy use than aphasia severity

## Another Interim Summary

- Different factors affect gestural skills in aphasia, including:
  - Semantic skills
  - Praxis
  - Executive function
- These factors may be more predictive than language scores

# Gesture Therapy

To enhance speech production

## Review of Gesture Therapy Studies (Rose et al, 2013)

- Combined verbal and gesture cues improve naming of treated nouns and verbs
- Some studies show carry over of treatment effects to measures of connected speech
- Effects often do not generalise to untreated words
- It is difficult to determine the independent contribution of gesture to treatment outcomes
  - Verbal cues are as effective as verbal + gesture cues

## Marongolo et al, 2010

- 6 people with aphasia
  - 4 non fluent speakers with good comprehension (phonological impairment)
  - 2 fluent speakers with poor comprehension (semantic impairment)
- Fluent speakers are more severely impaired than non fluent speakers

## Therapy

- 3 sessions per day over 2 weeks
- Three treatments compared:
  - Observe action and say verb
  - Observe action, execute action, say verb
  - Observe action, execute meaningless movement, say verb

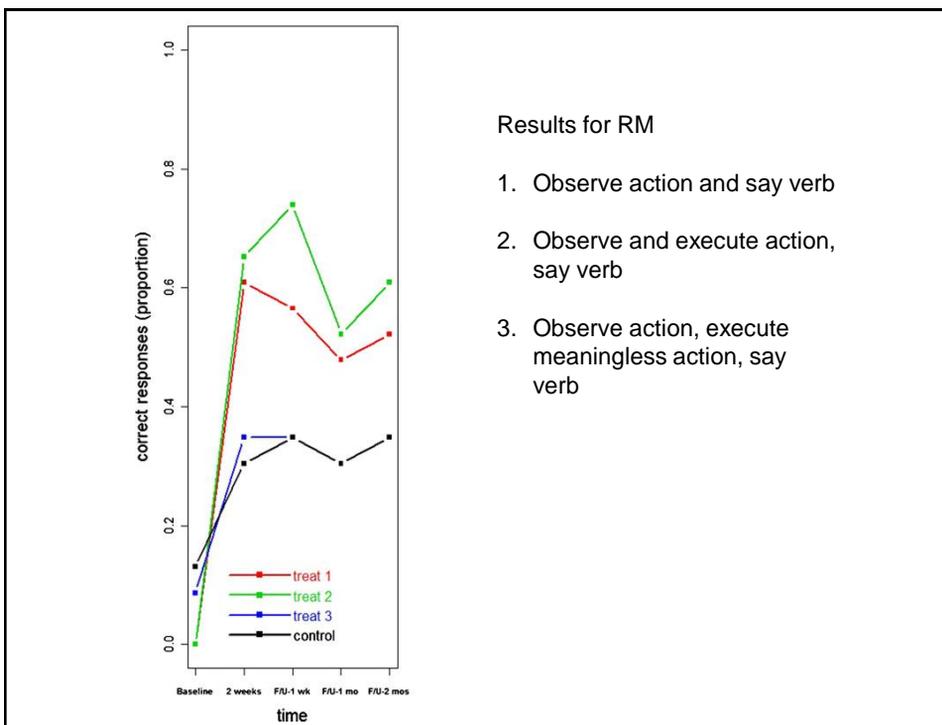


## Outcome Measure

- Naming video clips of actions
- Selected from 128 items
- Items not named at baseline go into experiment, split into 4 groups:
  - One group for each mode of therapy
  - One untreated group

## Findings

- No benefits for individuals with fluent aphasia/semantic impairment
- Significant benefits for non fluent speakers
- Equal benefits from action observation and execution



## Conclusion

- Further evidence that gesture can cue speech production
- Benefits also arise from just observing actions (involvement of mirror neurones?)
- Benefits do not generalise to untreated words
- Semantic skills may predict therapy benefits

# Gesture Therapy

As a compensatory modality

## Review of Gesture Therapy Studies (Rose et al, 2013)

- Several studies show gains in gesture production as a result of gesture therapy
- Few studies explore communicative gains arising from compensatory gesture therapy

## Marshall et al, 2012; Caute et al, 2013

- Study Questions
  - Can people with severe aphasia learn gestures?
  - Can people with severe aphasia learn words?
  - How does learning of gestures compare with learning of words?
  - Is there any cross modality generalisation? e.g. does gesture therapy cue speech?
  - Can participants use acquired gestures &/or words to convey messages and stories to a partner?

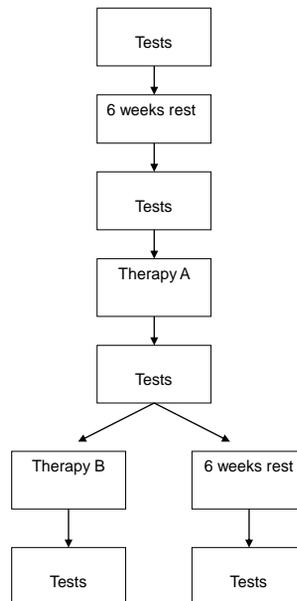
**Stroke**  
association



## 14 Participants

- Severe aphasia (<20% on CAT spoken naming subtest)
- At least 6-months post stroke
- Regular conversation partner (friend/family member/partner/spouse)
- English-speaker before neurological injury

## The Design



## Assessment Stimuli

60 items

- Divided into 3 groups:
  - 20 for gesture therapy
  - 20 for naming therapy
  - 20 untreated



## Tests

At each assessment point:

- Gesturing 60 items from pictures
- Naming 60 items from pictures
- Conveying 30 messages
- Conveying 3 video narratives

## Gesture and Naming Tests

What is this? Show me with your hands and face



Tell me the name of this

## Scoring Gestures

- Videos shown to student scorers
- 1<sup>st</sup>: Scorers guess target ('blind' condition)
- 2<sup>nd</sup>: Scorers chose target from 4 options ('select' condition)
- In both conditions scorers are unaware of the time of assessment

## Message Assessment

**Question:** *Can participants use acquired gestures and words to convey messages to their partner?*

- 2 messages for each item
- Questions, comments, commands, requests

## Examples of Messages

- I take two pills



- Would you like a beer?



## Message Administration

- Each message shown to the aphasic person (partner not present)
- Aphasic person attempts to convey message to the partner.
- Partner writes down their understanding of the message
- 30 messages administered at each assessment point (10 from each group)

## Scoring Messages

- Scripts are shown to 2 raters, blind to time of assessment
- Raters compare partner's script to target and rate each message out of 4 (against given criteria)

## Video Narratives

**Question:** *Can participants use acquired gestures and words to tell a story to their partner?*

## Videos

- 3 silent videos shown at each assessment point
  - Treated repeated
  - Untreated repeated
  - Untreated unrepeated

## Videos Administration

- Participant watches video twice, then tells partner the story (partner has not seen the video)
- Can use speech, writing, drawing, gesture
- Partner can ask questions to clarify
- Partner writes script

## Scoring Videos

- Partner scripts shown to 2 raters who are blind to time of assessment
  - Raters compare with list of 10 main events
  - Score each event out of 4 (against given criteria)
- E.g. Restaurant:**
1. They read / look at menu
  2. Waitress takes order / they order food
  3. They chat
  4. They drink wine
  5. The food is disgusting / He spits out the food
  6. They complain to waiter
  7. They wait for new food
  8. The new food is ok / they eat the new food
  9. They pay the bill
  10. They leave / get up and go

## Therapy A

- 15 hours
- Two 1 hour sessions per week
- Conversation partner not involved in therapy
- ½ naming, ½ gesture
- Single items

## Therapy A

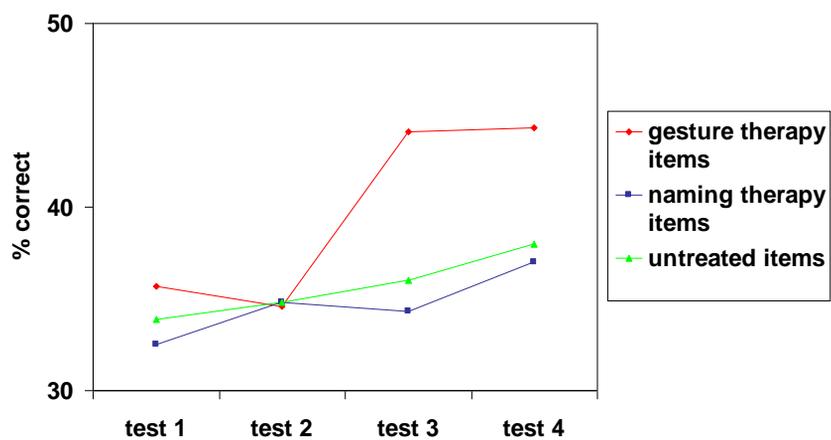
- Comprehension of gesture/word
- Production
- Barrier task
- One block (5 items) per session, unless all tasks completed

## Therapy B

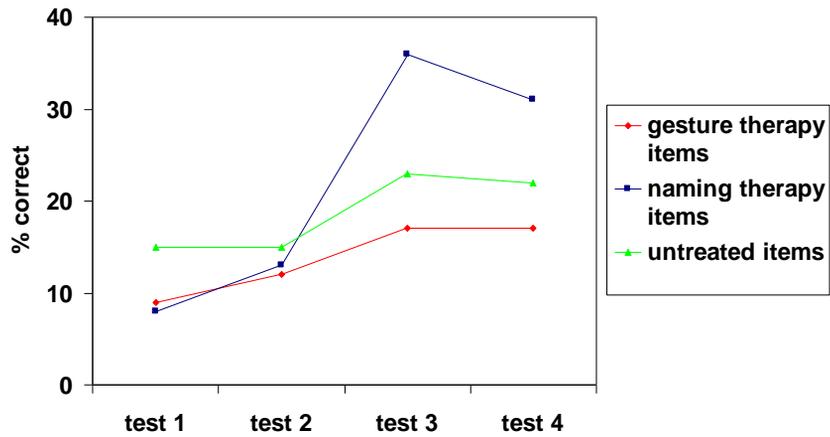
- Personalised goal setting
- Identify strategies, e.g.:
  - Gesture key item
  - Signal yes/no
  - Gesture 'you are close'
- Practice strategies in increasingly complex tasks:
  - Convey picture → recounting news story

# Results

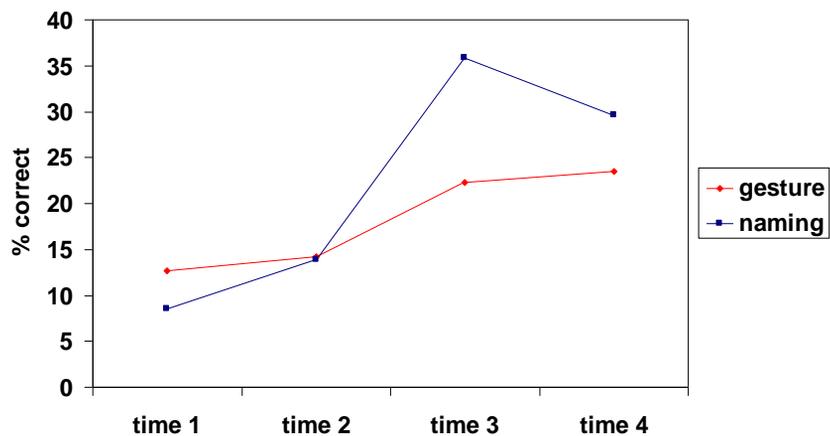
## Gesture Results (blind & select)



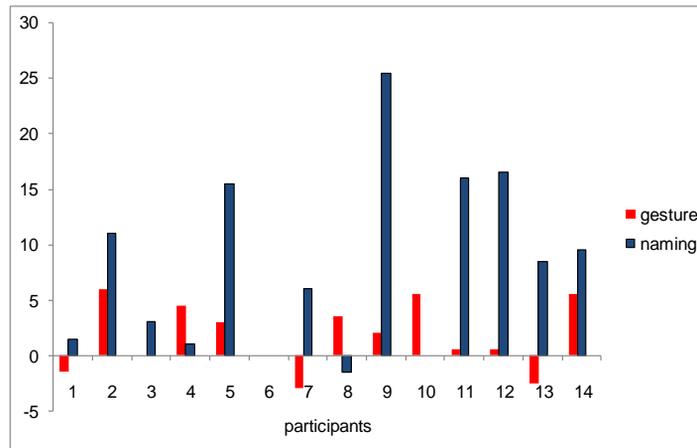
## Naming Results



## The Play Off: Gesture (blind) vs Naming



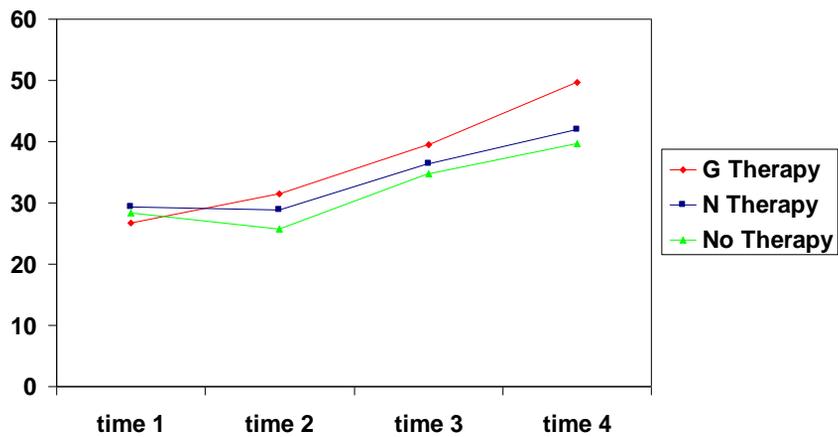
## Individual Gain Scores



## Messages

- Message scripts scored by blind raters (0 – 4)
- Scores expressed as %

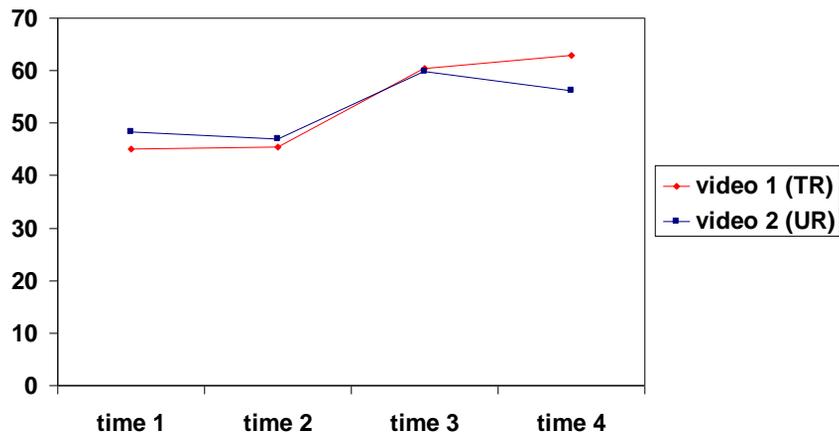
## Message Results



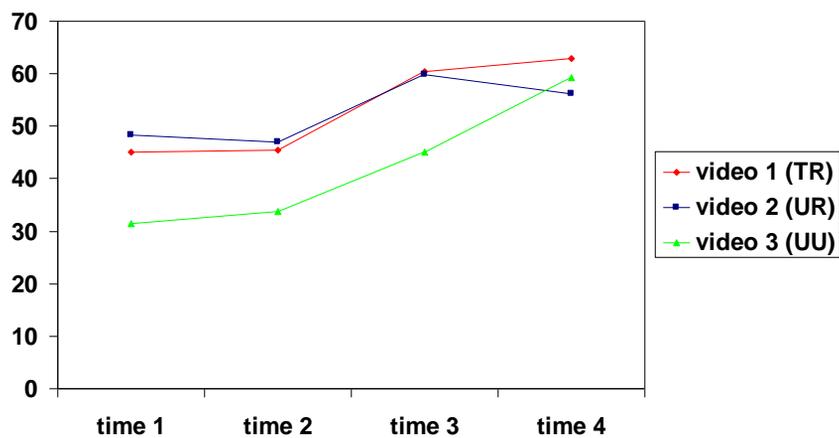
## Video Narratives

- Partner scripts scored against proposition list
- Raters blind to time of assessment
- Each proposition scored 0 – 4
- Scores expressed as %

## Video Narrative Results



## Video Narrative Results



## Conclusions

- Participants made significant gains on gesture production in response to gesture therapy
- Participants made significant gains on word production in response to naming therapy
- There was no cross modality generalisation from either type of therapy
- Gains from naming therapy were greater than gains from gesture therapy
- There were modest improvements on the communication tasks, which were not specific to treated items

## General Conclusions

- All human beings use gesture
- Gestures support communication and may facilitate speech
- There is evidence of gesture preservation in aphasia
- However, some people with aphasia show gesture impairments; others do not exploit its full potential

## General Conclusions

- There are two broad gesture therapy approaches:
  - As a cue for speech
  - As a compensatory modality
- Positive outcomes have been documented from both approaches
- Generalisation of effects to everyday communication is often not reported