Computer Therapy Tools for People with Aphasia

Professor Jane Marshall
Overview

• Rationales

• Therapy applications
  – Language remediation
  – Compensation

• Projects at City University London
  – GReAT
  – Remote Therapy Delivery
  – EVA
Rationales

• Efficiency savings
• Delivery of an intensive treatment dose
  – Associated with positive outcomes (Bhogal et al, 2003)
• Autonomy and self determination for the person with aphasia
• Opportunities for personalisation of therapy materials
• May offer a strategic solution for an impairment
  – (e.g. Text to Speech software)
• May be more acceptable to clients than paper and pencil materials
• Social inclusion
• Face saving
Language Remediation

- Computerised delivery of therapy exercises
- Self administered or administered with therapist support
- Can target different aspects of processing and different modalities
- Can be hierarchically structured
- Can be constructed from personalised vocabulary
- Several reports of positive outcomes, e.g.: 
Graded exercises

- Repetition
- Naming
- Spelling
- Word comprehension
- Sentence production

Figure 2. Sample exercises from StepByStep®.

e.g. Mortley, Wade, Hughes & Enderby, 2004
Palmer et al 2012

- 34 participants with Chronic stroke and aphasia
- Randomised to intervention and control group

<table>
<thead>
<tr>
<th>Control group:</th>
<th>Intervention group:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual care</td>
<td>Usual care + Step by Step</td>
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<tr>
<td>Communication support groups</td>
<td>Personalised progression through exercises</td>
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<tr>
<td></td>
<td>Supported by volunteer</td>
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<td></td>
<td>Advised to practise at least 3 times a week for 20 minutes</td>
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<td></td>
<td>5 months</td>
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Results

• 11 people completed the intervention with the recommended intensity
• 4 practised less intensively (of these, 3 had no volunteer support)
• 2 lost to follow up @ 5 months
• 4 lost to follow up @ 8 months

Participants undertook an average of 25 hours independent practice with 4 hours volunteer support and 4 hours 23 minutes SLT input
Improved word retrieval for Intervention Group

![Graph showing word retrieval improvement over follow-up months.]

Only participants with primary outcome data during follow up (complete cases) included

**Figure 2.** Percentage of words named correctly in intervention and control groups.
Experiences of Users
(Wade et al 2004)

• Intensive, daily use
• Self determined regime
  ‘The computer is better – you can do it any time when you want to’
• Independence of use varied:
  ‘She couldn’t have done it without me’
  ‘It’s something he can do away from me’
• Perceived benefits in
  – Therapy tasks
  – Word finding and language production
  – Wider computer skills, e.g. started to use internet or email
  – Confidence
    ‘It was something he was achieving .. And it wasn’t just the speech like I say, the Internet and email was something he could do, he felt proud that he could do .. It raised his self esteem quite considerably’
Interim Conclusions

• Intensive self administered computer practice is achievable, although
  – May depend on volunteer/relative support
  – Subject to individual variation (Archibald et al 2009)
• Significant gains reported in targeted skills
• User responses are positive
• Associated benefits in confidence, self esteem, and wider use of technology
Compensation

• Uses computer tool to
  – Scaffold output (rather than remediate skills)
  – As a communication aid
SentenceShaper

• Computer aid that:
  – Stores snippets of recorded speech
  – Replays snippets, when the relevant icon is pressed
  – Allows snippets to be ordered into connected speech:
    • First into sentences
    • Then into narratives
  – Provides lexical supports via personalised side buttons, e.g.
    • Offering high frequency verbs
Typical Therapy Programme

• The therapist trains the aphasic person to use the software, e.g:
  – How to record fragments of speech
  – How to order the fragments
  – How to make use of the side buttons

• The aphasic person practises with SentenceShaper at home
• Regular catch up meetings with the therapist
• Use of the soft ware remotely monitored.
Findings

• Practice with SentenceShaper makes speech:
  – More grammatical
  – More informative
• Gains observed in aided and unaided production
  – (e.g. Linebarger et al 2000; 2004; 2007)
Communication Aid: TouchSpeak

• Hand held aid to support communication
• Personalised vocabulary of words, and sentences
Hierarchical organisation of content

Ready made utterances

Represented in words or pictures
Research Findings
(Van de Sandt-Konderman et al, 2007)

• 35 people with severe aphasia
  – At least 6 months post stroke
  – Most with right hemiplegia

• 2 Therapy Phases (12 hours)
  – Developing and accessing vocabulary
  – Using vocabulary in chosen situations
Outcomes

• 56% of users able to access a vocabulary of over 100 items

• Significant gains on the Scenario Test
  – (involves scenarios that are different from those trained with TS)

• Significantly improved ratings of communication in trained situations

• High user satisfaction ratings
  – (70% of participants rated TS as good, very good or excellent)
Further Interim Conclusions

• Computers can help to compensate for aphasia by
  – Scaffolding output
  – Providing a communication aid
• Even people with severe aphasia can benefit
• Gains are observed in tests of everyday communication
• Participants views are positive
Projects at City University London

GReAT
Gesture Recognition in Aphasia Therapy
Project Aims

• To develop a computer gesture therapy tool for independent home based practice

• To pilot the tool with participants who have severe aphasia
Phase 1: Participatory Design

• Engaging end users in design process

• 5 Consultants with aphasia

• Each took part in 9 participatory design sessions exploring:
  - Computer gesture recognition
  - Presentation options (3D worlds)
  - Navigation options
The Prototype
Key Features of GeST

- Separate keyboard
- Gesture recognition
- Gestures presented in isolation & in context
- 3D worlds
Pilot Study Questions

• Will practice with Gest improve participants’ production of gestures &/or spoken words?
• Will improvements be specific to items that feature in the programme?
• Will gains occur when Gest is used without ongoing therapist support?
• Will gains be maintained after Gest is withdrawn?
• What are participants’ views about Gest?
• What are carers’ views about Gest? (where relevant)
• Is Gest easy and enjoyable to use?
Participants

• 9 people with severe aphasia
  – Consent to take part
  – Fluent pre-stroke users of English
  – Naming score <20%
  – Able to recognise pictures
  – No known dementia or other cognitive impairment
Consent

Screening

Tests (1)

3 Weeks Practice

Tests (2)

3 Weeks Practice

Tests (3)

3 weeks no tool

Tests (4)

Total time commitment: about 14 weeks
Practice Phases

- Each last 3 weeks
- Each practise 15 gestures with the tool
- Phase 1: Weekly visits from therapist
- Phase 2: Initial but no weekly visits
Tests

• 60 items
  – Gesture from picture
  – Name from picture

Items:
30 practised with GeST
• Supported GeST
• Independent GeST
15 familiarised only
15 controls
Results
Gesture Recognition Scores

- Supported Gest
- Familiarised
- Independent Gest
- Controls
Gesture Recognition Scores

![Graph showing Gesture Recognition Scores over time for Supported Gest, Familiarised, Independent Gest, and Controls. The y-axis represents scores ranging from 0 to 4.5, and the x-axis represents time points from time 1 to time 4. Each line represents a different group with distinct markers and colors.]
Gesture Recognition Scores

![Graph showing gesture recognition scores over time]

- **Supported Gest**
- **Familiarised**
- **Independent Gest**
- **Controls**
Usage Logs

- Record
  - Number of sessions
  - Length of sessions
  - Levels of programme accessed
Number of hours used in GeST by each participant (both phases combined)

Mean usage: 13.9 hours (range: 7.6 – 39.3 hours)
Mean number of sessions: 64.4 (range 20 – 95)
Qualitative Observations: Some ‘Carer’ Comments
Independence of Use

• ‘She uses it all on her own, I don’t know how to operate it’

• The first session I stayed with L, after that I’ve helped only if she’s found something particularly frustrating’

• All comment that the participant initiated use of Gest
Views about Technology

• ‘I was a technophobe and when they said ‘computer’ I thought it was going to cause problems. I thought I wouldn’t understand and he wouldn’t understand it. But it’s so ‘easy’
Reservations

• Carry over to real life (1 carer):

  • ‘while she works on it here (points to computer) it doesn’t necessarily translate’

  • She wanted a hankie last night and didn’t make a gesture’
Conclusions re GeST

- Using GeST improved practised gestures but only with therapist support
- Gains were maintained after GeST was withdrawn
- Gains were small and did not generalise to unpractised items
- There were no benefits for spoken naming
- Most users undertook intensive practice
- Views about GeST were very positive

(Marshall et al, in press)
Remote Delivery of Aphasia Therapy

Charles Wolfson Charitable Trust

Bupa Foundation
Research Questions

• Can the same protocol of therapy be delivered
  – Face to face?
  – Remotely from the University?
  – Remotely from a clinical site?
• Is there good treatment fidelity?
• What are the technological challenges?
• What are participants’ views about the therapy?
• Does therapy improve word production?
• Can remote supported conversation be delivered using student volunteers (attention control)?
Study Design

20 Participants:

- Remote therapy from the University
- Remote supported conversation (attention control)
- Face to Face Therapy
- Remote therapy from a clinical site
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Study Design

- Therapy Manual developed and followed in all treatment wings
- Coding check list for fidelity
- 12.5% of sessions coded by non treating therapist
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- Is there good treatment fidelity?
- **What are the technological challenges?**
- **What are participants’ views about the therapy?**
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Study Design

- Consultancy phase
- Human Computer Interaction assessments
- Interviews with participants
- Narrative record
Research Questions

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  – Face to face?
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• Is there good treatment fidelity?
• What are the technological challenges?
• What are participants’ views about the therapy?
• **Does therapy improve word production?**
• Can remote supported conversation be delivered using student volunteers (attention control)?
Study Design

Single case repeated measures design

100 words

50 treated

50 untreated

Pre / Post Therapy Testing

• Picture naming
• Conversation
Research Questions

• Can the same protocol of therapy be delivered
  – Face to face?
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• Is there good treatment fidelity?
• What are the technological challenges?
• What are participants’ views about the therapy?
• Does therapy improve word production?
• Can remote supported conversation be delivered using student volunteers (attention control)?
Study Design

• Conversation protocol developed
• Speech and Language Therapy student volunteers trained to deliver protocol
Preliminary Naming Results: 4 Participants in Remote Therapy Wing
Evaluating the effects of a virtual communication environment for people with aphasia
Study Questions

Will involvement in a tailor made virtual environment:

- Benefit the communication skills of 20 people with aphasia?
- Reduce feelings of social isolation?

Is the environment easy to access?

What are participants views about it?
Study Stages

Build a virtual communication environment for people with aphasia, using participative design

 Populate the environment with support workers (as avatars)

 Give 20 people with aphasia access to the environment

 Explore communication and social benefits
Final Conclusions

• Technology can
  – Support language remediation
  – Develop strategic skills
  – Provide communication aids
  – Enhance therapy efficiency
  – Generate novel opportunities for social participation

• User views are positive
• Feasibility is demonstrated for a range of technologies
• People with aphasia can (and should) be involved in the development of technology
• Likely to be increasingly pivotal to service delivery (see Golashesky, 2008 for model)
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