How should we treat apraxia of speech?

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Speech learning/intervention

• How much is our philosophy of therapy influenced by general culture of education (and language teaching in particular)?

• Teacher/therapist instructs by sharing declarative/conscious/explicit knowledge of [X] with learner.

• Therapists knows about articulatory phonetics; this knowledge shared with patient; patient acquires knowledge & relearns speech control.
  • Microstructural (also articulatory-kinematic or sound production therapy).
  • Therapy rebuilds segmental plans & provides practice in combining gestures to form cohesive syllables:
  • Typically, ‘easy’ sounds combined with set of maximally different vowels.
Evidence-Base for Microstructural Therapy

  • Majority of research on microstructural/articulatory therapies
  • Outcomes: Learning of targeted gesture/syllable but poor generalisation of learning
  • If therapy uses nonsense syllables, therapy might lead to little functional gain in speech.

• Cochrane Review (2009): “No evidence was found for the treatment of AOS.”

• Therapists view as *hard-to-treat* condition.
Concerns about being explicit

• Speakers have explicit knowledge about some aspects of language (e.g. vocabulary), but in other areas knowledge is procedural & implicit (syntax, speech control), Ullman (2001).

• Articulatory therapy based on premise that declarative knowledge converted to procedural knowledge.

• Internal focus of attention (e.g. directing attention to position of muscles) leads to less automaticity in complex motor skill learning that an external focus (Wulf, et al., 2001. Quart. J. Expt. Psych.).

• Ballard et al. (2011). Motor Control. Poorer retention of novel speech movement in healthy learners with kinematic feedback on location of tongue (EPG), than those without feedback.
<table>
<thead>
<tr>
<th>Microstructural Therapy</th>
<th>Whole word Therapy</th>
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</thead>
<tbody>
<tr>
<td>Sub-components of movements</td>
<td>Whole words/utterances</td>
</tr>
<tr>
<td>Isolated motor processing e.g. non-speech gestures; nonsense syllables</td>
<td>Connectivity: sensory-perceptual; linguistic</td>
</tr>
<tr>
<td>Declarative/conscious knowledge</td>
<td>Procedural knowledge</td>
</tr>
<tr>
<td>Errorful learning</td>
<td>Errorless learning</td>
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Therapy Dose

• Ample evidence that low-dose therapy ineffective in achieving significant behavioural gains (e.g., Pulvermüller, et al. 2001; Bhogal, et al.,2003; Bowen et al., 2012; Leff & Howard, 2012).

• Challenge of achieving high-dose intervention in cost-effective way.

• Use of computer self-managed therapy model.
Example Interfaces
Intervention Study

• 51 participants with chronic AOS\(^+\) (min. 5 months post-onset).

• Loaned laptop. Advised to use intervention regularly for short periods (‘little and often’). Supported by visiting T in early stages. Program records user interactions.

• 6-week intervention period

• Study design: Cross-over
  • Participants complete two ‘interventions’: active (speech) vs. sham (visual)
  • 4-week rest phase between interventions
  • Randomised to two groups: speech-first vs. sham-first
Baselines (x2) & Randomisation

Tx 1 (6 weeks)
- Speech
- Sham

Tx 2 (6 weeks)
- Sham
- Speech

Maintenance (8 weeks)
- Re-test

N = 51

N = 44
Visual Sham Intervention
Outcome Measures

- **Speech Production** repetition & naming single words; plus spontaneous speech samples at baseline & maintenance
- 3 word sets (35 words each)

<table>
<thead>
<tr>
<th>Treated</th>
<th>Phonetically-matched Untreated</th>
<th>Non-matched Untreated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Door</td>
<td>Game</td>
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</table>

- **Untreated behaviours**
  - **Written word-picture matching** (PALPA 48, Kay et al., 1992)
  - **Spoken sentence-picture matching** (CAT, Swinburn et al., 2004).
- **Cost-effectiveness assessment**
Generalisation to Un-Tx Words

<table>
<thead>
<tr>
<th>Tx: ‘Dog’</th>
<th>P-match ‘Door’</th>
<th>U-tx.‘Game’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant improvement</td>
<td>Significant improvement</td>
<td>No change</td>
</tr>
<tr>
<td>$z = -3.825$ $p &lt; .0001$</td>
<td>$z = -2.884$ $p &lt; .004$</td>
<td></td>
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</tbody>
</table>

Whiteside et al (2012) Neuropsychological Rehabilitation
Compliance with ‘little and often recommendation’

• Program use (hours:mins in 42 day period)
  • Speech program: 3:32 – 50:29; $M=16:48$
  • Sham program: 0:41 – 50:09; $M=14:54$
• No significant difference between sham/speech-first groups in level of use of either program
Summary & Conclusions

• Intervention study with large sample of patients, administered single treatment protocol.

• Self-administered, IT-based therapy may represent cost-effective way of resolving dosage problem.

• Word-level therapy for AOS was effective.

• Effects most evident on treated word forms.

• Gains on treated words maintained.

• Evidence of generalisation to phonetically-similar untreated words (although no wholesale generalisation).
Collaborators

Sandra Whiteside & Patricia Cowell
(University of Sheffield)

Research team
Lucy Dyson; Lesley Inglis; Abigail Roper: Tracey Young

Additional collaborators
SLTs across South Yorkshire, & in particular Rotherham NHS

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Conflict of Interest Statement

Sword Software

• Software program is commercially available
• ‘Inventors’ Varley, Whiteside & Cookmartin receive share of royalties from sales
Thank you


Input 1
- Computer models errorless spoken word-picture matching

Input 2
- Computer models errorless spoken-written word matching

Input 3
- Interactive: Participant performs spoken word-picture matching task

Input 4
- Interactive: Participant performs spoken-written word matching task

Input 5
- Computer models errorless spoken lexical decision task

Input 6
- Interactive: Participant performs spoken lexical decision task

http://www.propeller.net/sword.htm
- Observe video of speaker saying target word
- Imagined production of words
- Immediate repetition of words
- Delayed repetition
- Repetition with audio-recording & playback
- Practice of target words in sentences
- Production of word in isolation, with cue support if needed