Principles of Action Observation Treatment for Adults with Aphasia

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Disclosures

- No financial or non-financial disclosures for any speaker or author.
Objectives & Outline

Objectives

• Discuss how sensorimotor integration can impact verb naming in adults with aphasia.
• Discuss evidence for action observation treatment in adults with aphasia.
• Describe the key factors in effective action observation treatment protocols.

Outline

• Embodied Cognition and Sensorimotor Theory
• Review of Action Observation Treatments
• Participant Profiles
• Technological Considerations
• Discussion and Conclusions

Classical Wernicke-Lichtheim-Geschwind Model Neurobiology of Language

The Perisylvian Cortex

The Arcuate Fasciculus

Recent studies indicate that mirror neurons are the neurobiological mechanism for the multimodal, i.e. sensorimotor & linguistic representations, that functionally link actions and verbs.

Neuroimaging studies of action observation and naming, verb sentence reading/comprehension, and verb naming provide evidence of activity in language and sensorimotor areas.

Thus, observing, naming, and executing actions activate the same network of sensorimotor regions in the brain.

(Pulvermüller, Hauk, & Harlé, 2003; Kable et al., 2003; Hauk, Johnsrud, & Pulvermüller, 2004; Tettamanti et al., 2005; Kemmerer et al., 2008; Desi, Binder, Conant, & Seidenberg, 2010; Cuellar & del Toro, 2017).
Evidence Supporting Action Observation Treatments (AOT)

AOT is based on theories of embodied cognition, and recent evidence regarding sensorimotor activity during language tasks involving verb comprehension, naming, or reading.

Protocols were developed to engage the sensorimotor system during linguistic processing of actions in order to strengthen verb naming in individuals with aphasia.

Generally, these studies involve the observation of the performance of an action, followed by an attempt to name the action.

Action Observation Protocol

The participant is asked to name each action in a single word response.

Actions are demonstrated live or shown in picture or video.

No cues or feedback are provided.
Marangolo et al. 2010: action observation vs action execution

Participants & Schedule
- n = 6; 1-6 years post stroke
- 4 nonfluent 2 fluent

Stimuli & Schedule
- 5 days/week; 30-45min each session; for 2 weeks
- 68-124 items based on pre-assessment of 128 verbs

Conditions
- Live Action Observation
- Live Action Observation + Action Execution
- Live Action Observation + Meaningless Movement
- Untrained list

Results
- Nonfluent participants improved > fluent
- Live Action Observation = Live Action Observation + Action Execution
**Marangolo et al., 2012: human vs nonhuman actions**

**Participants**
- n = 7; 11months-10years post stroke
- all nonfluent aphasia

**Stimuli and Schedule**
- 5days/week for 2 weeks;
- 115 items (78 human, 37 nonhuman actions) each presented 1x per day

**Conditions**
- All items presented as videos
- Human and nonhuman actions

**Results**
- Only human actions significantly improved

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**Bonifazi et al., 2013: live action vs video action**

**Participants**
- n = 6; 15mo-5 years post stroke
- all nonfluent; 4 with phonological impairments, 2 with semantic impairments

**Stimuli & Schedule**
- 5 day/week for 2 weeks
- 52-120 items based on pre-assessment

**Conditions**
- Live Action Observation
- Live Action Observation + Action Execution
- Video Action Observation
- Live Action Observation + Meaningless Movement

**Results**
- No change for semantically impaired participants
- Significant change for phonologically impaired participants
- No significant difference between live action and videos
Further Development of Action Observation Treatment

Routhier et al., 2015: observation vs. cued

Participants
- n = 2; 9 and 37 years post stroke
- nonfluent aphasia

Stimuli & Schedule
- 3 90-minute sessions/week for 3 weeks
- 37 items in each condition

Conditions
- Cued, uncued, and untrained lists
- Cue hierarchy: sentence completion; phonemic; slp said verb and participant repeated it

Results
- Cued list was significantly improved compared to both uncued and untrained
- No difference between uncued and untrained
Routhier et al., 2016: Tablet self-administered delivery

Participants
• n = 2; 1 and 6 years post stroke
• Fluent and nonfluent aphasia

Stimuli & Schedule
• Approximately 30 words in each list
• 4 sessions/week for 5 weeks

Conditions
• Cued list, uncued list, untrained
• Cue hierarchy: sentence completion, phonemic, written verb; stated verb

Results
• Nonfluent participant had significant improvement on cued list for post-treatment and maintenance; no change on uncued or untrained

del Toro & Cuellar: Video vs picture

Participants
• n=2; 3 and 15 years post stroke;
• Both have nonfluent aphasia

Stimuli & Schedule
• 31 items in each condition
• 3x/week; 3 rounds of each stimuli each session

Conditions
• Picture vs Video

Results
• P1 did not significantly improve at 1 week post-treatment for either list; accuracy returned to baseline levels at 1 month post-treatment
• P2 did not significantly improve at 1 week post-treatment though accuracy for both lists was above baseline
The Scoping Review conducted in 2019 found that all verb naming treatments, including those involving action observation / naming protocols, represented a relatively “low” level of evidence. Although, findings are encouraging and the studies are replicable.

Following treatment, verbs were not assessed in sentences, functional communication, or discourse.

Cued or uncued—may depend on severity of verb impairments.

Outcome measures should include generalization to untrained verbs in isolation and in sentences and functional communication such as discourse. Inclusion of personally salient verbs may have an impact.

AOT: Establishing the protocol

- Live or video actions.
- Fairly intense and frequent schedule.
- Transitive or intransitive verbs.
- Arm, leg or face actions.
### AOT: Building a Patient Profile

<table>
<thead>
<tr>
<th>Phonologic impairments</th>
<th>Severity range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All studies have reported greater improvement in patients with phonological impairments.</td>
<td>Poor performing participants from 3 studies have limited verb naming; some had limited verb comprehension.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hemiparesis/motor impairments</th>
<th>Cognition: verbal working memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routhier et al. (2015; 2016) suggested motor deficits could impact the activation of SMI needed to support action observation.</td>
<td>Routhier et al. (2015) reported both participants had deficits in verbal working memory.</td>
</tr>
<tr>
<td>Suspected deficits for P1 based on difficulty learning to navigate the treatment program and to name action.</td>
<td></td>
</tr>
</tbody>
</table>

### Home-based treatment delivery

<table>
<thead>
<tr>
<th>Technological Skills</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open/close and navigate PowerPoint.</td>
<td>2 sessions</td>
</tr>
<tr>
<td>Click on icons for cues and to progress to next slide.</td>
<td>Home practice guide—tailor to the patient.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tracking Treatment Fidelity</th>
<th>Availability of Caregiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/week for probes</td>
<td>Technological difficulties</td>
</tr>
<tr>
<td>Self-reporting with treatment log.</td>
<td>Cue for verb form</td>
</tr>
</tbody>
</table>
Identifying who would benefit

- In groups or pairs review handout with 3 patient cases
- For each case decide if AOT is appropriate, considering the following factors:
  - Language profile
  - Severity
  - Motor impairments
  - Cognitive impairments
  - Technological skills
  - Accessibility
  - Support
- We’ll discuss in 5min...
Building Your Own AOT Program

PowerPoint
• Embed videos, one per slide
• Audio cues can be created using Insert → Audio
• Insert icon for cues

Procedural Cues

Building Your Own AOT Program: Home Practice Guide

Gentilucci, M., & Dalla Volta, R. (2008). Spoken language and arm gestures are controlled by the same motor control system. Psychology, 61(6), 944-957.


