A Review of Aphasia Rehabilitation Approaches with a focus on Promoting Generalization

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Iowa Conference on Communicative Disorders
March 29, 2019
Aphasia most often due to left hemisphere stroke – language center of the brain
Aphasia

- Acquired language disorder
- Most commonly caused by stroke
- Can affect all aspects of language
- Aphasia manifests differently for different people.
- But in ALL cases, there are word retrieval difficulties.
- The memories, personality, and intellect of a person with aphasia are NOT affected.
- Bilingual or multilingual aphasia occurs in people who speak two or more languages

Reduced ability to convey thoughts, ideas, emotions can result in social isolation, depression and reduction in participation in life.
“Scott”
What is the picture (subject-verb-object)?

• He's a having a ice cream.
• Ice cream?
• That's it. I think that's it.
• Two of them. Two things.
• And He's fying (frying) them out.
• He is uh uh. He's a man.
• And he's um. He's sort of nice right now but he - old guy.
• Um He's old actually. I think.
• And and the things here.
• With a ra- uh. Oh so close.
• He rides with a hoce (horse). Hoce (horse).
Clinical Observations

- For more nonfluent aphasia
  - Increase production of individual words and words in a sentence (subject, verb, (object))
  - Increase specificity/accuracy of those words
- For fluent aphasia (more general, empty output)
  - Increase specificity/accuracy of words in already fluent speech
  - Reduce pronoun, nonspecific, jargon output
- Not necessarily either-or – it’s a continuum
- Lexical retrieval is at the heart of both
Importance of Generalization

• “[T]he process by which the effects of therapy extend to material or circumstances not explicitly taught during speech-language therapy sessions” (Nadeau, Gonzalez-Rothi, & Rosenbek, 2008)

• “…without doubt one of the most important outcomes of successful treatment for aphasia. [W]ithout evidence of generalization, treatment may be deemed ineffective” (Thompson, 2006)

• Essential for intervention to have an important impact on daily communication (Nadeau et al., 2008)

• Practical/Logistical reason: Limited # of tx sessions – need to maximize effects
Two Types of Generalization

Response Generalization
• Changes in untrained language behavior
• Example: Train naming on a set of words, and see improvement to related untrained words
  – Chair → bed
  – apple → orange
  – book → magazine

Stimulus Generalization
• Changes in untrained language conditions
• Across partners/environments
• Example: Train naming of single words and see improvement in lexical retrieval in discourse or conversation (Thompson, 2006)
Living with Aphasia: Framework for Outcome Measurement

World Health Organization, ICF Model

Figure 1. ICF schematic. Reprinted with permission from: the International Classification of Functioning, Disability and Health (ICF), World Health Organization, 2001.

Kagan et al., 2006
Important To Evaluate Multiple Levels of Language at Assessment Timepoints

- Observed in the treatment research (e.g., Edmonds, 2016; Webster & Whitworth, 2012)
- Improvement is NOT necessarily hierarchical
- Cannot assume that lack of improvement at one level means that there is not improvement at a “higher” level
- Some of this has to do with effect of constraint
- It is important to evaluate generalization at many levels!
- Can build this into goals and reassessment measures
Hierarchical Word Retrieval Measures (Selected Examples)

- Confrontation naming
  - Nouns (Philadelphia Naming Test)
  - Northwestern Assessment of Verbs and Sentences (NAVS)
  - Object and Action Naming Battery (if available to you)
  - Comprehensive Aphasia Test (CAT)
- Sentences
  - Comprehensive Aphasia Test (CAT)
  - NAVS
- Discourse
  - Nicholas & Brookshire (1993)
  - AphasiaBank protocol

- Functional communication measures questionnaires
  - Communicative Effectiveness Index (Lomas et al., 1989)
  - Aphasia Communication Outcome Measure (ACOM) (Hula et al., 2015)
- Communicative Abilities of Daily Living-2 (CADL-2) (Holland et al., 1998) (Test of functional communication)

NOT a comprehensive list of tests!
# Hierarchy of Outcome Measures: Single Word Naming and Sentence Materials

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Scissors" /></td>
<td><img src="image2" alt="Dog barking" /></td>
</tr>
<tr>
<td><img src="image3" alt="Height chart" /></td>
<td><img src="image4" alt="Children playing" /></td>
</tr>
<tr>
<td><img src="image5" alt="Bucket" /></td>
<td><img src="image6" alt="2-place animate" /></td>
</tr>
<tr>
<td><img src="image7" alt="Man washing" /></td>
<td><img src="image8" alt="2-place inanimate" /></td>
</tr>
<tr>
<td></td>
<td><img src="image9" alt="3-place" /></td>
</tr>
</tbody>
</table>
Discourse Stimuli and Measures
(Nicholas & Brookshire, 1993, 1994)

• 10 discourse elicitation measures
• Procedural, personal, picture descriptions, short narratives
• Available on ASHA website (publications).
• Good test-retest reliability, normative data
• Some normative data in Spanish/English bilinguals (Edmonds, 2014; Rivera & Edmonds, 2018)
Discourse Considerations

Discourse Stimuli
Different types of discourse have varying cognitive and linguistic demands

Cognitive Demands and Discourse Type

- Picture Description
- Story generation
- Conversation
- Procedural discourse
- Story retell/summarization

- Try to evaluate spoken and written discourse, when possible!
- People use the writing modality (e.g., texts, social media), so important to assess and treat
Basic Steps for Analysis

• **Select Your Sample Type**
  *multiple samples best (Nicholas & Brookshire, 1993)
  *300-400 words best (Nicholas & Brookshire, 1993)
  *5 min conversation best (Boles & Bombard, 1998)

• **Transcribe The Output and Segment into Utterances**
  Two possibilities (there are more):
  – Propositions (meaning, not syntactic).
    Often good with minimal output. (E.g., Dog/Boy/Lady drinking./Lake)
  – T-units. Subject-Verb + embedded or dependent clause.

• **Then Decide What Measures You Want**
  – Micro
  – Macro
Segmenting the Utterance: T-unit (Hunt, 1965)

- The shortest “grammatically” allowable sentence
- A T-unit is an independent clause PLUS any dependent clauses
- Co-ordinate clauses (joined by and, but, etc.) would be considered two t-units

Examples

- The boy ran to the window and watched the rain. (1 T-unit)
- The boy ran to the window / and he watched the rain. (2 T-units)
- Billy, Sarah’s brother, ran to the window. (1 T-unit)
Levels of Discourse Analysis

Microstructure
Word and sentence level. Two examples:
- Correct information units (CIUs) (Nicholas & Brookshire, 1993)
- Complete utterances (CUs) (Edmonds et al., 2009)

Macrostructure
Overall discourse framework
- Topic maintenance
- Coherence
- Cohesion
- Organization
- Story Narrative/grammar

List not comprehensive
Correct Information Units (CIUs): Word-Level Measure of Informativeness

Dog runs, no no barks. A man, man in tree. They do ladder. Girl is, no, wants dog. No. The other one. 22 words

Dog runs, no no **barks**. A man, **man in tree**. They do **ladder**. **Girl** is, no, **wants** dog. No. The other one. **8 CIUs**

No penalty for morphological, phonological/distortion errors.

\[
\text{No penalty for morphological, phonological/distortion errors.}
\]

\[
\frac{\text{# CIUs}}{\text{# words}} \times 100 = \%\text{CIU}
\]

\[
8 \div 22 \times 100 = 36.3\% \text{ CIUs}
\]

**Interpretation:** 36% of words (not repeated) are relevant to the topic and novel (informative)

We also evaluate CIUs/min for efficiency. (Gives much different info than WPM).

(Nicholas & Brookshire, 1993)
The man was running for the dog. He went up on the tree the bark was barking ok. And then he the fire fire fire fireman climbed the tree, to save it. The girl she, um, the girl had a cat on the tree and she’s waiting to uh to save his, his cat. He had a tricycle, ladder, he have a um fire um firetruck. Has a bird on the tree.”

41/67 = 61% CIU

Nicholas & Brookshire 1993
The man he went up in tree.  The dog is barking ok.  And then he the fire fire fireman do it.  The girl, um the girl wants cat.  Ladder, a ladder there.  Bird sings  I don’t like it.
Complete Utterances (CU)
(e.g., Edmonds et al., 2009; Edmonds, 2014)

- Considers informativeness/relevance of content words in a sentence frame (SVO)
- Can evaluate informativeness (REL) and SVO structure separately and together
- An increase in %CU indicates increase in ability to produce meaningful words within a complete sentence frame

<table>
<thead>
<tr>
<th>UTTERANCE</th>
<th>SVO?</th>
<th>REL?</th>
<th>COMPLETE?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tree is open.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>The son is flying a kite</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>To walk through the step.</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>A little guy with some sand on the shore with his hands the sand.</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Very good test-retest reliability with people with aphasia (.984, p<.001) (Akers & Boyle, 2018)
# CU Group Practice

<table>
<thead>
<tr>
<th>Utterance</th>
<th>SV</th>
<th>REL</th>
<th>CU</th>
</tr>
</thead>
<tbody>
<tr>
<td>The man he went up in tree.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The dog is barking ok.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>And then he the fire fire fireman do it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The girl, um the girl wants cat.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ladder, a ladder there.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird sings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t like it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nicholas & Brookshire 1993
## Basic Discourse Results

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL # WORDS</td>
<td></td>
</tr>
<tr>
<td>TOTAL # UTTERANCES</td>
<td></td>
</tr>
<tr>
<td>TOTAL TIME</td>
<td></td>
</tr>
<tr>
<td>%CIUS</td>
<td></td>
</tr>
<tr>
<td>%UTTERANCES</td>
<td></td>
</tr>
<tr>
<td>%CIUS/MIN</td>
<td></td>
</tr>
<tr>
<td>OTHER OBSERVATIONS (MACRO, TYPES OF ERRORS, ETC.)</td>
<td></td>
</tr>
</tbody>
</table>
Functional Communication: Communicative Effectiveness Index

The Sixteen Items of the Communicative Effectiveness Index (CETI)*

Please rate [name]'s performance for that particular communication situation.
1. Getting somebody's attention.
2. Getting involved in group conversations that are about him/her.
3. Giving yes and no answers appropriately.
4. Communicating his/her emotions.
5. Indicating that he/she understands what is being said to him/her.
6. Having coffee-time visits and conversations with friends and neighbors (around the bedside or at home).
7. Having a one-to-one conversation with you.
8. Saying the name of someone whose face is in front of him/her.
9. Communicating physical problems such as aches and pains.
10. Having a spontaneous conversation (i.e., starting the conversation and/or changing the subject).
11. Responding to or communicating anything (including yes or no) without words.
12. Starting a conversation with people who are not close family.
14. Being part of a conversation when it is fast and there are a number of people involved.
15. Participating in a conversation with strangers.
16. Describing or discussing something in depth.

For communication partners

• Four categories (developed with people with aphasia and families):
  – Basic needs (eating)
  – Expressing health
  – Life skills (using phone)
  – Social needs (dinner conversation)

4. Communicating your emotions.
   Not at all able  |  As able as before stroke

5. Indicating that you understand what is being said to you.
   Not at all able  |  As able as before stroke

Lomas et al., 1989
Aphasia Communication Outcome Measure (ACOM)

• Patient reported outcome measure of communicative functioning in people with aphasia
• Questions fall into the following categories: general communication, conversation, aud. Comprehension, writing/numbers, recitation/sequences and naming
• Available for computer administration and paper/pencil
• Long form (56 items) and short form (15 items) available with high correlation (r²=.91)
• HELPFUL ARTICLE AND VIDEO ON THE ACOM

Hula et al., 2015, JSLHR, vol 58, 906-919
Example of ACOM output

<table>
<thead>
<tr>
<th>Item</th>
<th>Item Text</th>
<th>Response</th>
<th>Equivalent Responses</th>
<th>T-Score Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A019 read product labels?</td>
<td>Mostly</td>
<td>Mostly</td>
<td>56.83</td>
<td>12.81</td>
</tr>
<tr>
<td>2</td>
<td>A055 talk about your future plans with family or friends?</td>
<td>Somewhat</td>
<td>Somewhat</td>
<td>44.95</td>
<td>6.86</td>
</tr>
<tr>
<td>3</td>
<td>A124 keep a conversation going?</td>
<td>Not very</td>
<td>Not very</td>
<td>39.96</td>
<td>5.69</td>
</tr>
<tr>
<td>4</td>
<td>A141 say the names of common objects (e.g. bed lamp pencil)?</td>
<td>Completely</td>
<td>Completely</td>
<td>40.94</td>
<td>6.23</td>
</tr>
<tr>
<td>5</td>
<td>A069 introduce yourself?</td>
<td>Somewhat</td>
<td>Somewhat</td>
<td>45.25</td>
<td>4.84</td>
</tr>
<tr>
<td>6</td>
<td>A089 understand magazine/newspaper articles?</td>
<td>Somewhat</td>
<td>Somewhat</td>
<td>44.53</td>
<td>4.33</td>
</tr>
<tr>
<td>7</td>
<td>A012 fill out simple forms?</td>
<td>Not very</td>
<td>Not very</td>
<td>42.18</td>
<td>3.63</td>
</tr>
<tr>
<td>8</td>
<td>A031 write a simple “to do” list?</td>
<td>Not very</td>
<td>Not very</td>
<td>41.13</td>
<td>3.41</td>
</tr>
<tr>
<td>9</td>
<td>A064 talk about your day with family or friends?</td>
<td>Not very</td>
<td>Not very</td>
<td>39.34</td>
<td>3.37</td>
</tr>
<tr>
<td>10</td>
<td>A166 start a conversation with other people?</td>
<td>Not very</td>
<td>Not very</td>
<td>38.25</td>
<td>3.24</td>
</tr>
<tr>
<td>11</td>
<td>A004 ask for information from store employees?</td>
<td>Due to some other reason</td>
<td>Doesn’t apply to me</td>
<td>38.25</td>
<td>3.24</td>
</tr>
<tr>
<td>12</td>
<td>A022 read signs in a store to find what you need?</td>
<td>Due to some other reason</td>
<td>Doesn’t apply to me</td>
<td>38.25</td>
<td>3.24</td>
</tr>
</tbody>
</table>

To get a copy of the computerized test, e-mail the test’s author, Dr. Will Hula: William.Hula@va.gov
Supported Conversation for Aphasia (SCA)

- NOT an aphasia treatment
- Purpose is to provide methods for person with aphasia and communication partners that will allow them to converse more effectively with each other and to meet everyday needs
- Quick look at self-directed module

NOTE: I will show one video from the self-guided module this link goes to, so I’ll need Internet connectivity.
Treatment Approaches

- Lexical Retrieval – spoken and written
  - Single words: Semantic Feature Analysis
  - Sentences/Discourse: Verb Network Strengthening Treatment (VNeST)
- Discourse: Attentive Reading and Constrained Summarization (ARCS and ARCS-W)

See handout for journal articles, websites, and more.
Impairment (Skill-Based) and Context-Based Treatment - NOT EITHER/OR!

**Context-Based**
Context-based treatments generally focus on compensatory strategies and use of all communication modalities in a functional context
- Ordering a coffee
- Stating or writing personal information
- Role plays for particular scenarios (e.g., meeting new people)

**Impairment**
Skill-based treatments attempt to address a specific breakdown in the cognitive-linguistic system
- Word retrieval in (written and/or spoken) in various contexts (naming, sentence production, and/or discourse)
- Auditory and/or reading comprehension
- More grammatically complex output

- More “top down”
- More explicit generalization
- People need to have cognitive-linguistic skills to use compensatory strategies

- More “bottom up”
- More implicit generalization

Ideally you want elements of both!
Clinical Observations

- For more nonfluent aphasia
  - Increase production of individual words and words in a sentence (subject, verb, (object))
  - Increase specificity/accuracy of those words
- For fluent aphasia (more general, empty output)
  - Increase specificity/accuracy of words in already fluent speech
  - Reduce pronoun, nonspecific, jargon output
- Not necessarily either-or – it’s a continuum
- Lexical retrieval is at the heart of both
Principles To Promote Generalization, Broadly Conceptualized

• Treatment plans with compensatory and impairment elements (see Nadeau et al., 2008)
  – Variety of partners and environments
  – Increased awareness of behavior (e.g., self-monitoring)
• Multimodality/central elements
  – Centrality of semantics
  – Centrality of verbs to sentences
• Consider Complexity Account of Treatment Efficacy (CATE) (Thompson et al., 2003)
  – Atypicality (e.g., Kiran & Thompson, 2003)
  – VNeST (e.g., Edmonds, 2016)
• High degree of semantic breadth in treatment
• High pt participation, effort, and saliency in treatment
• Considering generalization in assessment, treatment plan, during tx, and with periodic and post-tx testing
SEMANTIC FEATURE ANALYSIS (SFA)
In principle, training at the semantic level can generalize to spoken and written comprehension and production due to centrality of the semantic system; **cross-function generalization** also increases functionality by promoting multimodality elements into treatment.
Semantic Feature Analysis Theory and Generalization

Activation of **shared features** results in **spreading activation** to other category members

1. Pt to name picture
   – Cueing hierarchy
2. Regardless of response, ask to generate features
   **Important:** This should be active, not passive. Pt should generate response (cues), even if that requires forced choice.
3. Pt to name picture again
   – Cueing hierarchy

Some studies have additional steps: sorting into categories, making semantic judgments

(e.g., Kiran & Thompson, 2003)
Typicality: All items in a category not created equally

How does this affect selection of items for treatment and generalization?
Results/Implications: Train Atypical Exemplars To Promote Generalization

Consistent with Complexity Account of Treatment Efficacy (CATE) (Thompson et al., 2003), where training more complex end of a construct can generalize to simpler form. This is MORE EFFICIENT than training simple and getting more complex!

(Kiran & Thompson, 2003)
SFA Outcomes (Boyle, 2010)

• >20 pts with range of aphasia type and severity evaluated. Replicated acquisition of trained items (≈75% of pts) and untrained nouns (≈50%). Limited generalization to discourse. See Boyle (2010) for review.

• SFA with verbs and within discourse (as a strategy) has also been done. See resources handout for references.
Generalization Schematic Based on Literature

<table>
<thead>
<tr>
<th>Nouns</th>
<th>Verbs</th>
<th>Sentences</th>
<th>Spoken Discourse</th>
<th>Written Discourse</th>
</tr>
</thead>
</table>

Please read treatment articles for details. See References and Resources.
SFA Stimuli Considerations

Choose stimuli from different categories
• More semantic breadth, potentially more generalization
• To promote semantic distinction, not interference/confusion

Try to incorporate atypicality
Periodically monitor improvement to untrained items

Ad hoc categories
• Categories with loose boundaries with a goal (Sandberg et al., 2012)
• E.g., grocery list
  – Typical: fruit, cereal, bread
  – Moderately typical: paper products, garbage bags, bleach
  – Atypical: batteries, pens, light bulbs
• E.g., things to pack for a trip

<table>
<thead>
<tr>
<th>Category</th>
<th>Less atypical</th>
<th>More typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furniture</td>
<td>Bookcase</td>
<td>Table</td>
</tr>
<tr>
<td>Fruit</td>
<td>Cantaloupe</td>
<td>Orange</td>
</tr>
<tr>
<td>Clothes</td>
<td>Robe</td>
<td>Shirt</td>
</tr>
<tr>
<td>Utensil</td>
<td>Ladle</td>
<td>Spoon</td>
</tr>
<tr>
<td>Footwear</td>
<td>Slippers</td>
<td>Shoes</td>
</tr>
</tbody>
</table>
Can add writing to SFA

Things to Consider

- E.g., Have them say **then write** the name of the trained item
- Increases pt engagement, adds functionality, esp. for pts w/ AOS, phonological output issues
- Focus on meaning, not spelling (e.g., if >1 letter off, have them copy correct spelling)
- Highly motivating for some pts
- Typed or written
- With computer, attach 2nd keyboard for clinician to gain control of cursor
Let’s consider treatment planning, goals and reassessment for SFA

• Treatment goals – What you measure during treatment.
  – Accuracy and cueing level for naming trained pictures
  • Spoken and/or written
  – Accuracy and cueing level for naming features
  • Spoken and/or written
  – Auditory comprehension of Yes/no questions
• Reassessment/Checking for generalization
  – Accuracy and cueing level for naming untrained *semantically related* pictures (e.g., dress if you trained skirt)
  • Spoken AND written
  – Lexical retrieval in sentences (e.g., NAVS) and discourse (e.g., Nicholas & Brookshire (1993))
  – Functional communication questionnaires for pt and family
Janet: Tx Rationale and Post-Tx Results

**Tx goals. Pt will:**
1. name trained nouns ind w/ 80% acc.
2. write first letter of word with 60% acc.
3. copy target words with 90% acc.
4. achieve 90% accuracy on auditory comp questions

**Generalization (post-tx testing). Pt will:**
- Name pics of nouns sem-related to targets with 50% acc (up from 10%).

**Follow-up testing**
- Naming (e.g., PNT)
- Sentences (e.g., NAVS)
- Discourse (Nicholas & Brookshire)
- ACOM or ALA questionnaire (see references)
- CETI with comm’n partner

<table>
<thead>
<tr>
<th>Trained (spoken and written)</th>
<th>Untrained (Generalize)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dress</td>
<td>Skirt</td>
</tr>
<tr>
<td>(Winter) Boots</td>
<td>Shoes</td>
</tr>
<tr>
<td>Taxi (live in NY)</td>
<td>Car</td>
</tr>
<tr>
<td>Sofa/couch</td>
<td>Bed</td>
</tr>
<tr>
<td>Mango</td>
<td>Orange</td>
</tr>
<tr>
<td>iPAD</td>
<td>(cell) phone</td>
</tr>
<tr>
<td>Purse</td>
<td>Wallet</td>
</tr>
<tr>
<td>Newspaper</td>
<td>Magazine</td>
</tr>
<tr>
<td>Beth (daughter)</td>
<td>Doctor</td>
</tr>
<tr>
<td>Coffee</td>
<td>Tea</td>
</tr>
</tbody>
</table>

Functional and diverse items. Writing introduced for multimodality production. Gestures and drawing used to encourage pt’s own responses, as needed.
VERB NETWORK STRENGTHENING TREATMENT (VNEST)
Clinical/Communication Need

- For more nonfluent aphasia
  - Increase production of content words in a sentence (subject, verb, (object))
  - Increase specificity/accuracy of those words
- For fluent aphasia (more general, empty output)
  - Increase specificity/accuracy of words in already fluent speech
  - Reduce pronoun, nonspecific, jargon output
- Not necessarily either-or – it’s a continuum
- Lexical retrieval is at the heart of both
Overall Goals of VNeST

• To promote **improved lexical retrieval** for words in sentences and/or discourse that are NOT TRAINED. Not compensatory.

• Big Picture: To increase a person’s ability to produce words that more closely convey his or her thoughts and ideas.
VNeST – Additional Goals

• Salient, relevant, engaging and challenging for participants
• Easily portable with minimal materials and preparation for clinician
• Multimodality
• Feasible via computer and telepractice
• Implementable in other languages
The Verb Network and Goals

RELATIONSHIP TO GOALS

- Activates and strengthens basic sentence structure (SVO).
- Activation and retrieval of specific words/concepts in sentences.
- Engages autobiographical and event memory - salient and relevant scenarios.
- Semantic Breadth -- Maximize generalization to untrained words in untrained communication contexts.

Priming (e.g., Ferretti et al, 2001; McRae et al, 2004)
Theoretical activation of broad semantic network → Generalization

- Verbs prime semantically related verbs (sweep-dust) (Rösler, Streb, & Haan, 2001)

- Findings from previous semantic treatments for nouns and verbs (Kiran & Thompson, 2003, Raymer & Ellsworth, 2002)

- VNeST findings (Edmonds, 2014)

(Edmonds & Babb, 2011)
**VNeST Protocol** (See Edmonds (2014) for tutorial)

**Step 1: Generate agents & patients**

- Wife
- Carpenter
- Lumber
- Sugar
- My wife
- Windows
- Chef
- Seamstress

**Step 2: Read responses aloud**

- "Wife measure windows"
- "Carpenter measure lumber"
- "Chef measure flour"

**Step 3: Expand one schema**

<table>
<thead>
<tr>
<th>Who</th>
<th>What</th>
<th>Where</th>
<th>When</th>
<th>Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wife</td>
<td>Measure</td>
<td>In the living room</td>
<td>Last weekend</td>
<td>Need new curtains</td>
</tr>
</tbody>
</table>

**Step 4: Semantic judgment of sentences (N=12)**

Correct: The surveyor measures land.
Incorrect agent: The doctor measures the door.
Incorrect patient: The chef measures the plant.
Reverse: The skirt measures the seamstress.

**Step 5: Independently produce verb**

**Step 6: Repeat Step 1 (without clinician cues)**
Treatment Protocol

Step 1

- Always encourage independent response first. If pt is unable to provide a response, then start with min cues.
- Ask for personal example (especially at first)
  - E.g., *Who drove you here today?*
  - E.g., *Who do you know that likes to bake?*
  - *What types of TV shows do you like to watch?*
- Semantic/context/constraint cues
Example of Cues (Edmonds, 2014)

Table 1. Semantic/Contextual Cues.

<table>
<thead>
<tr>
<th>Semantic/Contextual Cues</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational</td>
<td>Can you think of someone who (measures, bakes, drives) for their job?</td>
</tr>
<tr>
<td>Avocational</td>
<td>Can you think of someone who (bakes, flies something) for a hobby or in their spare time?</td>
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<tr>
<td>Familial</td>
<td>Can you think of a friend or someone in a family or your family who (bakes, knits, drives, reads)?</td>
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<tr>
<td>Sports</td>
<td>Can you think of someone who (kicks, watches, shakes something) as part of a sport/sporting event?</td>
</tr>
<tr>
<td>Location</td>
<td>Can you think of someone who (chops something in a forest? Pushes something in a grocery store? Shakes something in a kitchen?)</td>
</tr>
</tbody>
</table>
Other use of minimal/semantic cues

- Can also be used to ensure that they are producing words with some semantic diversity.
- In the video, the pt had produced the following for boil.

```
Who
Nanna
Chef
Cook

Boil

What
Potatoes
Corn on the cob
Carrots
```

- Pt is technically doing everything required, but we want to promote semantic breadth in responses.
- This is very important since you want to promote widespread semantic activation to potentially facilitate greater generalization.
If needed, Max cues

- Provide one correct response with foils
- E.g., Who measures?
- If they cannot read independently, read them together. They will improve!
- Do not lay them all out for them to choose from – One at a time!
Diversity of responses

- 11 participants, 10 verbs each
- Produced an average of 145 different agents and 138 patients per participant during 10 weeks of treatment
  - One-third novel in first half (5 weeks)
  - One-third novel to second half (5 weeks)
  - One-third produced throughout
<table>
<thead>
<tr>
<th>Type</th>
<th>Examples of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototypical</td>
<td>Quarterback-throws-football</td>
</tr>
<tr>
<td></td>
<td>Woman-carries-pocketbook</td>
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<tr>
<td>Personal</td>
<td>Boss-drives-big truck</td>
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<tr>
<td></td>
<td>“Fluffy”-shakes-toy</td>
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<tr>
<td></td>
<td>I-read-funny pages</td>
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<tr>
<td></td>
<td>I-measure-car bumper (for job)</td>
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<td></td>
<td>Uncle-boils-shrimp</td>
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<td></td>
<td>“Nancy” (wife)-sews-curtains</td>
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<tr>
<td>Encyclopedic/world knowledge</td>
<td>Judge-reads-constitutional law</td>
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<td></td>
<td>Ox-pull-wagon</td>
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<td></td>
<td>State police-weigh-trucks</td>
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<tr>
<td></td>
<td>Benjamin Franklin-fly-kite</td>
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<tr>
<td></td>
<td>Mrs. Clinton-writes-biography</td>
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<tr>
<td>Other</td>
<td>Mad scientist-boil-head of Frankenstein</td>
</tr>
<tr>
<td></td>
<td>Vampires-bite-humans</td>
</tr>
</tbody>
</table>