Lexical Retrieval Treatment for Primary Progressive Aphasia

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Disclosure

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Primary Progressive Aphasia (PPA)

- Slowly progressive onset of language impairment that is NOT due to focal brain damage
  - no acute neurological event
  - no stroke
  - no head injury
  - no tumor
- In the absence of other cognitive changes
- Associated with relatively focal cortical atrophy

Primary Progressive Aphasia

- A focal atrophy syndrome where language processes are affected first

- Diagnostic criteria (Mesulam, 2001; Neary et al., 1998)
  - At least two years of isolated language impairment
  - Absence of
    - forgetfulness for recent events
    - significant apathy or disinhibition
    - visuospatial impairment
    - visual recognition deficits
    - sensorimotor dysfunction

But note that ultimately, PPA may be accompanied by behavioral and personality changes and other cognitive symptoms
Patient description of PPA
Primary Progressive Aphasia

• Like aphasia resulting from focal lesion, progressive aphasia may involve impairments of
  • Lexical retrieval (anomia is often the first sign)
  • Semantics
  • Phonology
  • Syntax/Morphology
  • Orthography (reading & spelling)
• or some combination

3D rendering of Left > Right cortical atrophy
Primary Progressive Aphasia Variants

- 3 major subtypes (variants) based on
  - speech & language behavior and
  - confirmed evidence of cortical atrophy or brain dysfunction (hypoperfusion, or hypometabolism) based on imaging (MRI, SPECT, or PET) (Gorno-Tempini et al., 2011, Neurology)

Regional Cortical Atrophy by PPA Variant

- **NFPA = Nonfluent Progressive Aphasia** (a.k.a. Nonfluent/Agrammatic Variant)
- **SD = Semantic Dementia** (a.k.a. Semantic Variant)
- **LP = Logopenic PPA** (a.k.a. Logopenic Variant)

Gorno-Tempini et al., 2004
Primary Progressive Aphasia Variants

Regions of significant cortical atrophy detected using voxel based morphometry \textit{(from Wilson et al. (2010, Brain)}

- **Logopenic Variant**
  - Left posterior perisylvian or parietal

- **Semantic Variant**
  - Left anterior temporal lobe

- **Nonfluent/Agrammatic**
  - Left posterior fronto-insular region

Composite image from Gorno-Tempini et al., 2004
Speech/Language Profiles by Variant

**Logopenic**
- **Deficits**
  - Impaired naming
  - Impaired repetition
  - Phonological errors
- **Strengths**
  - Semantics
  - Speech Production
  - Grammatical skills

**Semantic**
- **Deficits**
  - Impaired naming
  - Single word comprehension
  - Object knowledge
- **Strengths**
  - Speech production
  - Phonological skills

**Nonfluent/Agrammatic**
- **Deficits**
  - Agrammatism
  - Speech production
  - Complex sentence comprehension
- **Strengths**
  - Single word comprehension
  - Object knowledge
Speech/Language Profiles by Variant

Logopenic
- Deficits
  - Impaired naming
  - Impaired repetition
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Nonfluent/Agrammatic
- Deficits
  - Agrammatism
  - Speech production
  - Complex sentence comprehension
- Strengths
  - Single word comprehension
  - Object knowledge
Lexical Retrieval Complaints

Logopenic Variant

Semantic Variant
Language Treatment for PPA

- PPA treatment is still relatively limited in clinical practice
  - There is a small, but growing, body of evidence demonstrating that some individuals with PPA can improve language in response to treatment

- Why should treatment work?
  - PPA reflects relatively focal cortical atrophy, especially in the earlier stages
    - Relatively healthy regions of the brain (particularly the language network) should be available to support language improvement
Language Treatment for PPA

- We examined two lexical retrieval treatments
  - Case series of 10 participants
- Given the progressive nature of the underlying disease processes, it is important to ask, Is behavioral treatment worth the effort?
  - Are treatment outcomes positive?
  - Relatively rapid?
  - Is there generalization?
  - What is the perceived benefit?
  - How durable are the improvements?
Participants: Pre-Treatment Profiles

7 Individuals with PPA
(5 Logopenic Variant; 2 Semantic Variant)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Time Post Onset</th>
<th>PPA Variant</th>
<th>WAB Aph Type</th>
<th>WAB AQ</th>
<th>BNT</th>
<th>MMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>EPS</td>
<td>M 80</td>
<td>~3.5 yrs</td>
<td>Logopenic</td>
<td>Conduction</td>
<td>68</td>
<td>5</td>
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<tr>
<td>P2</td>
<td>RPR</td>
<td>M 73</td>
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<td>Anomic</td>
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<td>P3</td>
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<td>M 75</td>
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<td>Anomic</td>
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<tr>
<td>P4</td>
<td>JPT</td>
<td>F 67</td>
<td>~2 yrs</td>
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<td>Anomic</td>
<td>82.2</td>
<td>13</td>
</tr>
<tr>
<td>P5</td>
<td>JPP</td>
<td>F 69</td>
<td>~2 yrs</td>
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<td>89.8</td>
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</tr>
<tr>
<td>P6</td>
<td>RPS</td>
<td>M 69</td>
<td>~5 yrs</td>
<td>Semantic</td>
<td>Anomic</td>
<td>62.7</td>
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<tr>
<td>P7</td>
<td>MPR</td>
<td>M 60</td>
<td>~1.5 yrs</td>
<td>Semantic</td>
<td>Anomic</td>
<td>90.2</td>
<td>19</td>
</tr>
</tbody>
</table>

**Average** 70.4 ~2.6 yrs 80.3 16.7 20.6
Treatment Approach

• Lexical Retrieval Cascade Treatment* (Beeson, Rising, & Henry)
  • Designed to improve lexical retrieval and to promote self-cueing
  • Train sequence of self-cueing techniques for lexical retrieval (maximize residual skills)
    • Semantic self-cuing
    • Orthographic/Phonological self-cuing

• Goals
  • Improve ability to name targeted items
  • Generalize to untrained items and contexts (if possible)
  • Increase content and efficiency in discourse

* for protocol details, see Henry, Rising, ... Beeson (2013). Brain & Language.
Promoting Self-cueing Strategies

Semantic elaboration

Write word  Write initial letter

Oral reading  Phonemic cue

Spoken Production

Semantics  Orthography  Phonology
Lexical Retrieval Cascade Treatment

Treatment procedure: Present Picture. “What is this?” Proceed through **self-cueing** and **stimulation** levels.

<table>
<thead>
<tr>
<th>Cueing Level</th>
<th>Clinician</th>
<th>Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic <strong>Self Cue</strong></td>
<td>“Tell me about it.”</td>
<td>“It’s in the kitchen. I use it for pancakes.”</td>
</tr>
<tr>
<td>Orthographic <strong>Self Cue</strong></td>
<td>“Can you write any part of the word?”</td>
<td></td>
</tr>
<tr>
<td>Phonemic <strong>Self Cue</strong></td>
<td>“What sound does that letter make?”</td>
<td></td>
</tr>
<tr>
<td><strong>Oral Reading</strong></td>
<td>Provide written name. “What does this say?”</td>
<td>Patient attempts to read word.</td>
</tr>
<tr>
<td><strong>Copy</strong></td>
<td>“Copy the word. Does that help you to say it?”</td>
<td></td>
</tr>
<tr>
<td><strong>Repetition</strong></td>
<td>“It’s a spatula.”</td>
<td>“Spatula”</td>
</tr>
</tbody>
</table>
Treatment Session

Using Self-Cueing to name photos

- Clinician cue, “What do you do when you get stuck?”
- Patient response, “I talk, yeah, I talk…. It’s huge. Even the baby is huge. She keeps it three years before it comes out….. **an elephant … Elephant!**”
- Named picture using semantic self cueing
- Immediately moved to next step of Cascade (writing)
Lexical Retrieval Cascade Treatment

- **Homework**
  - Daily homework
  - Provide written directions to guide self-cueing
  - Stimuli presented in recordable photo album.
    - Homework can also be presented in video format via recordable DVD or Youtube.

- Two levels of support for homework tasks based on participant ability.
Homework Instructions

Cascade Only

1. Look at picture. Try to say the name.
2. Talk about the picture. Try to say the name.
3. Try to write the name of the picture. Try to say the name.
4. Look at the first letter. Try to write the word.
5. Listen to the first sound. Try to say the word.
6. Look at the written word. Read it out loud.

Criteria:
Able to produce target words within treatment session with self-cues.

Cascade + Additional Stimulation

1. Look at picture. Try to say the name.
2. Talk about the picture. Try to say the name.
3. Try to write the name of the picture. Try to say the name.
4. Look at the word. Try to say it.
5. Listen to it. Repeat it.
6. Copy the name and say it. (10 times)
Lexical Retrieval Cascade Treatment

Stimuli – participant selected

Tx Schedule
2 x per week (1-hr each)
Daily homework
80% criterion/set of 5
Average length of treatment:
5.5 weeks (range 4-7.5 weeks)

Example Multiple Baseline Data
Pre-post treatment naming

6 weeks
Lexical Retrieval Cascade Treatment
Results: Naming of Targeted Items

Group Performance

Individual Performance

Logopenic Variant

Semantic Variant
Treatment is Strategic
Results: Examining Generalization

Boston Naming Test

% Correct

<table>
<thead>
<tr>
<th></th>
<th>Pre Post</th>
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<th>Pre Post</th>
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<td>P2</td>
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<td>P7</td>
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Logopenic Variant

Semantic Variant
Increase in meaningful semantic information during circumlocution
Results: Examining Generalization

Boston Naming Test

Pre Post        Pre Post        Pre Post         Pre Post         Pre Post        Pre Post           Pre Post
P1          P2         P3         P4          P5           P6                     P7

Meaningful Semantic Information
Correct

Logopenic Variant
Semantic Variant
Generalization To Discourse

- Content analysis of three picture descriptions (Nicholas and Brookshire, 1993)
  - Percent Content (Content Information Units/Total Words)
  - Efficiency (Content Information Units/Minute)
- 6/7 participants completed picture descriptions pre-post treatment
Perception of Treatment Outcome
Patient Perception of Treatment Outcome

Compared to BEFORE treatment, how is your ....

1. Ability to say the words you have **practiced**?

2. Ability to **use strategies** to help come up with the names of **untrained** words?

3. Overall ability to **say the names of things**?

4. Overall **ease of communication** (speaking, reading, writing, understanding)?

5. Overall **confidence** about communication?
Can additional improvement be achieved?

- Several participants wanted to continue treatment to improve lexical retrieval
  - Intensive lexical retrieval protocol
  - Effective for improving lexical retrieval in individuals with PPA with milder anomia (Henry et al, 2008; Beeson et al, 2011)
  - For some individuals with PPA, may be a logical next step of a treatment sequence.
Generative Naming Treatment

• Semantically based lexical retrieval treatment
  • Train strategies for lexical retrieval in the context of generative naming tasks by semantic category
  • Strengthen the use of strategies trained in Lexical Retrieval Cascade

• Rationale
  • Generative naming within a semantic category stresses the lexical retrieval process

• Here we report on 6 individuals with PPA
  • 3 individuals who proceeded from Lexical Retrieval Cascade Treatment to Generative Naming Treatment
  • 3 individuals who received Generative Naming Treatment only
Three Participants who had completed Lexical Retrieval Cascade Treatment

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<td>Time</td>
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<td>Post Onset</td>
<td>WAB</td>
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<td></td>
<td></td>
<td></td>
<td>Variant</td>
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<tr>
<td>P4</td>
<td>JPT</td>
<td>F</td>
<td>67</td>
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<td>82.2</td>
</tr>
<tr>
<td>P5</td>
<td>JPP</td>
<td>F</td>
<td>69</td>
<td>2 yrs</td>
<td>Logopenic</td>
<td>89.8</td>
</tr>
<tr>
<td>P7</td>
<td>MPR</td>
<td>M</td>
<td>60</td>
<td>1.5 yrs</td>
<td>Semantic</td>
<td>90.2</td>
</tr>
</tbody>
</table>

Individual Performance On Trained Items

- **Logopenic Variant**
  - P4
  - P5

- **Semantic Variant**
  - P7

Bar chart showing performance with red bars for Post and blue bars for Pre.
Participants: Generative Naming Treatment

6 Individuals with PPA
(5 Logopenic Variant; 1 Semantic Variant)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Time Post Onset</th>
<th>Variant</th>
<th>WAB AQ</th>
<th>BNT</th>
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<td>P4JT</td>
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<td>30</td>
</tr>
<tr>
<td>P7MR</td>
<td>M</td>
<td>60</td>
<td>1.5 yrs</td>
<td>Semantic</td>
<td>90.2</td>
<td>19</td>
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<tr>
<td>P8AW</td>
<td>M</td>
<td>77</td>
<td>2.5 yrs</td>
<td>Logopenic</td>
<td>91.3</td>
<td>26</td>
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<td>P9MG</td>
<td>M</td>
<td>69</td>
<td>2 yrs</td>
<td>Logopenic</td>
<td>95.3</td>
<td>47</td>
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<tr>
<td>P10HH</td>
<td>M</td>
<td>62</td>
<td>1 yr</td>
<td>Logopenic</td>
<td>93.6</td>
<td>57</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>67.3</td>
<td>1.8 yr</td>
<td></td>
<td>90.4</td>
<td>32</td>
</tr>
</tbody>
</table>

Rec’d Cascade Tx first
Generative Naming Treatment

- Twelve Semantic Categories selected based on interest to each participant and pre-treatment ability to name items in each category.
  - 6 “living” (e.g., birds, insects, vegetables)
  - 6 “nonliving” (e.g., tools, musical instruments, furniture)
- Six categories entered into training (3 living, 3 non) and the remaining 6 probed as control categories
- Daily treatment sessions for 1.5-2 hours
  - Each category trained for 2 days
  - Twelve treatment sessions in all
Generative Naming Procedure

Treatment Session

• Probe all categories. “Name all of the tools you can think of.” 1 minute time limit per category.
• Train targeted category for the day
  • Present color photos of items in category
    • Name pictured items using strategies learned in Lexical Retrieval Cascade or with prompts to use self-cueing (for new participants)
• Semantic elaboration tasks
  • Identify semantic features
  • Identify subcategories for sorting/organizing items
  • Recount personal experiences (especially for semantic dementia)
Naming and Organizing

Colorful Birds

BIRDS

Birds of Prey

Water Birds

Wild Birds
Treatment Session

- Sorting pictures by category
- Using semantic self-cueing for naming
Generative Naming Homework
Daily Homework

- Train homework procedures during therapy session

Homework Activities:
- Sort items into subcategories
- Create written lists of subcategories and add new items
- Complete semantic feature “maps” of items in targeted categories.

[Diagram of blender]

<table>
<thead>
<tr>
<th>blender</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it used for?</td>
</tr>
<tr>
<td>___________</td>
</tr>
</tbody>
</table>
Homework

Appliances

Large

Small-Kitchen

Bathroom

Used for Chores

- Sort Pictures into Categories
- Say/Write Name
- Add 1-2 more items/category

- washer
- dryer
- coffee pot
- crock pot
- hair dryer
- steamer
Generative Naming
Pre/Post Treatment

Category: Automobile Parts and Accessories

Pre-Treatment: 4 items named
Post-Treatment: 15 items named
Results: Generative Naming

Group Performance

- Trained:
  - Pre: [Average Items per Category]
  - Post: [Average Items per Category]
  - Statistical Significance: * p<.003

- Untrained:
  - Pre: [Average Items per Category]
  - Post: [Average Items per Category]

Individual Performance (Trained Categories)

- P4: Logopenic
- P5: Logopenic
- P7: Semantic
- P8: Logopenic
- P9: Semantic
- P10: Logopenic

Bar charts comparing pre and post performance for trained and untrained categories, with significant improvement post-training indicated by * symbol.
Results: “Real life” Gains
Results: Examining Generalization

Boston Naming Test

Pre Post P4       Pre Post P5       Pre Post P7       Pre Post P8       Pre Post P9       Pre Post P10

Logopenic         Semantic        Logopenic
Results: Generalization To Discourse

**Content**
- Controls: [Bar Chart]
- PPA Patients: [Bar Chart]

**Efficiency**
- Controls: [Bar Chart]
- PPA Patients: [Bar Chart]

**Individual Performance-Content**
- P4, P5, P7, P8, P9, P10: [Bar Chart]

- Logopenic: [Bar Chart]
- Semantic: [Bar Chart]
- Logopenic: [Bar Chart]
Patient Perception of Treatment

“It’s improved my ability to gossip.”
Patient Perception of Treatment

1. Ability to name things? It is

2. Ability to **name** words in the category you **practiced**? It is

3. Ability to “come up with the word” you are looking for in conversation? It is

4. Overall speaking ability? It is

5. Overall **confidence** level regarding spoken communication. It is
Summary of Pre-Post Changes

- 8 Logopenic, 2 Semantic
- 7 Received the Lexical Retrieval Cascade Treatment
- 3 Received only the Generative Naming Treatment
- 3 Received both treatments
# Summary of Pre-Post Changes

<table>
<thead>
<tr>
<th>Participant</th>
<th>P1 EPS</th>
<th>P2 RPR</th>
<th>P3 BPB</th>
<th>P4 JPT</th>
<th>P5 JPP</th>
<th>P6 RPS</th>
<th>P7 MPR</th>
<th>P8 APW</th>
<th>P9 MPG</th>
<th>P10 HPH</th>
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<tbody>
<tr>
<td>WAB AQ</td>
<td>-7.6</td>
<td>+8.2</td>
<td>0</td>
<td>-0.2</td>
<td>-6.3</td>
<td>+.2</td>
<td>+.6</td>
<td>+.9</td>
<td>+.5</td>
<td>-1.2</td>
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<td>+.6</td>
<td>+.9</td>
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<td>-1.2</td>
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<tr>
<td>WAB Repetition</td>
<td>-4</td>
<td>+5</td>
<td>-16</td>
<td>-6</td>
<td>-13</td>
<td>-2</td>
<td>+2</td>
<td>-3</td>
<td>+6</td>
<td>-2</td>
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<tr>
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<td>-16</td>
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<tr>
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## Summary of Pre-Post Changes

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<th>Participant</th>
<th>P1 EPS</th>
<th>P2 RPR</th>
<th>P3 BPB</th>
<th>P4 JPT</th>
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- Variability, but generalization to at least some lexical retrieval tasks.
- Recall that this is in the context of progressive impairment.
“Protective” Effect of Therapy

Repetition
WAB Object Naming
MMSE

4 months no Tx
4.5 weeks Tx
2 month follow up
What have we learned?

- Were treatment outcomes positive? YES
- Were they relatively rapid? YES
- Was there generalization? YES
  - Varied across individuals and contexts
- Did participants perceive benefit? YES
- How durable were the improvements? Uncertain
  - Expect that they will be variable.

So, is behavioral treatment worth the effort? YES
Final Thoughts
Acknowledgements

The Aphasia Research Project
Andrew DeMarco
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Rachel King
Chelsea Bayley
Christie Shultz