Treating Naming Impairments in Primary Progressive Aphasia

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Disclosure

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Primary Progressive Aphasia (PPA)

- Slowly progressive onset of language impairment
  - due to neurodegenerative disease
- No acute neurological event or focal lesion
  - no stroke, head injury, tumor
- Often affects individuals <65 years
- Language/speech difficulties most prominent initial clinical feature
  - Absence of
    - forgetfulness for recent events
    - visuospatial impairment
    - visual recognition deficits
    - significant apathy or disinhibition
    - sensorimotor dysfunction

But note that ultimately, PPA may be accompanied by behavioral and personality changes and other cognitive symptoms
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

- The behavioral impairment profile reflects the location of relatively focal cortical atrophy
Primary Progressive Aphasia Variants

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

Regional Cortical Atrophy by PPA Variant

- **NFV** = Nonfluent/Agrammatic Variant
- **SV** = Semantic Variant (a.k.a. Semantic Dementia)
- **LV** = Logopenic Variant

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

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

Nonfluent/Agrammatic Variant
- Left posterior fronto-insular region
- Reduced grammatical complexity
- Effortful speech production

Semantic Variant
- Left anterior temporal lobe (bilateral temporal lobe atrophy is common, L > R)
- Anomia
- Fluent but empty speech
- Impaired object knowledge

Logopenic Variant
- Left posterior perisylvian or parietal
- Anomia
- Impaired repetition
- Impaired phonology

Region of Predominant Atrophy by variant
Primary Progressive Aphasia Pathology

The PPA variants are associated with different underlying disease processes.

**Associated Disease Processes**
- **Nonfluent/Agrammatic Variant**
  - Frontotemporal lobar degeneration (FTLD)
- **Semantic Variant**
  - Frontotemporal lobar degeneration (FTLD)
- **Logopenic Variant**
  - “Atypical” Alzheimer’s Disease

**Typical Pathology**
- Aggregation of the tau protein, primarily in frontal regions.
- Elevated levels of the protein TDP-43 in the temporal lobes.
- Plaques: Deposits of beta-amyloid protein & Tangles: Twisted tau protein fibers
Primary Progressive Aphasia Pathology

PPA

- Nonfluent variant = Tau
- Semantic variant = TDP-43
- Logopenic variant = plaques/tangles

FTLD

Alzheimer’s Pathology
Differential Diagnosis of Primary Progressive Aphasia

- Definitive diagnosis at autopsy
  - Identification of underlying pathology
    - Amyloid PET scans: In vivo imaging of amyloid plaques
- Structural imaging may not reveal clear patterns of atrophy early in the disease process
- Careful evaluation and description of language characteristics important
  - Guide intervention
Speech/Language Profiles by Variant: Nonfluent/Agrammatic

- **Deficits**
  - Decreased grammatical complexity
  - Speech production
  - Complex sentence comprehension

- **Strengths**
  - Single word comprehension
  - Object knowledge

[Video Clip]
Speech/Language Profiles by Variant: Semantic Variant

- **Deficits**
  - Impaired naming
  - Single word comprehension
  - Object knowledge

- **Strengths**
  - Speech production
  - Phonological skills
  - Episodic memory
Speech/Language Profiles by Variant: Logopenic Variant

- **Deficits**
  - Impaired naming
  - Impaired repetition
  - Phonological errors

- **Strengths**
  - Semantics
  - Speech Production
  - Grammatical skills

Video Clip
### What does PPA progress to?

<table>
<thead>
<tr>
<th>Variant</th>
<th>Initial Language Symptoms</th>
<th>Progression</th>
<th>Other domains</th>
<th>Time to death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonfluent/agrammatic variant</td>
<td>Simple sentence structure, speech production difficulties</td>
<td>Agrammatism → Progression to mutism</td>
<td>- Extrapyramidal features of PSP/CBD - Behavioral problems consistent with Behavioral variant FTD</td>
<td>≈9 yrs</td>
</tr>
<tr>
<td>Semantic variant</td>
<td>Anomia, comprehension deficits (word level)</td>
<td>Speech becomes increasingly empty → semantic jargon → mutism</td>
<td>- Emergence/worsening of behavioral problems; - “profound pragmatic disturbance”</td>
<td>≈12-14 years</td>
</tr>
<tr>
<td>Logopenic variant</td>
<td>Anomia, phonological impairment</td>
<td>Phonemic jargon → mutism</td>
<td>- Concomitant cognitive decline affecting memory, visuospatial skills, calculation, behavior</td>
<td>more variable (5-20 years)</td>
</tr>
</tbody>
</table>

Adapted from M. Henry, 2016 ANCDS
PPA Treatment:
Staged treatment approach
(Henry & Fried-Oken)

- Assess → Treat → Assess → Treat
- Goals evolve with symptom progression
- 3 broad stages
  1. Restorative/Restitutive
  2. Shift toward aided approaches
  3. Environmental support and partner training
- Stages are not mutually exclusive
- Treatment sequences may help to maximize restitution of function
Language Treatment for PPA

• Restitutive/Restorative approaches
  • Small but growing body of evidence demonstrating that some individuals with PPA can improve (or maintain) language skills 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 should be available to support language improvement
Lexical Retrieval Treatment for PPA

- Lexical Retrieval Treatments
  - Most widely represented treatment approaches in the PPA literature
  - Typical treatments retrain specific items
    - Stimulation approaches (e.g., using verbal repetition and rehearsal of picture names)
  - Patients demonstrate successful relearning of targeted items
    - Often little generalization and poor maintenance
  - Treatment designed to engage spared cognitive-linguistic processes may lead to better generalization and maintenance
Arizona Lexical Retrieval Cascade*

- Designed to engage spared cognitive processes to improve lexical retrieval
  - Relatively early in disease process
  - Restitution of function
- Promotes self-cueing
  - Train sequence of self-cueing techniques for lexical retrieval
- Goals
  - Improve ability to name targeted items
  - Train strategies for lexical retrieval
  - Generalize to untrained items and contexts (if possible)

* for protocol details, see Henry, Rising, ... Beeson (2013). Brain & Language.
Lexical Retrieval Treatment for PPA: Central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. Is there generalization?
4. How durable is generalization?
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?

Is behavioral treatment worth the effort?
## Treatment Participants

<table>
<thead>
<tr>
<th>Participant</th>
<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>
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<tr>
<td>P1</td>
<td>ELS</td>
<td>M</td>
<td>80</td>
<td>~3.5 yrs</td>
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<td>Conduction</td>
<td>68.0</td>
<td>5</td>
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<td>P2</td>
<td>JLT</td>
<td>F</td>
<td>67</td>
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<td>Anomic</td>
<td>82.2</td>
<td>13</td>
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<tr>
<td>P3</td>
<td>LLP</td>
<td>F</td>
<td>69</td>
<td>~2 yrs</td>
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<td>Anomic</td>
<td>83.0</td>
<td>15</td>
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<td>Anomic</td>
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<td><strong>2.8 yrs</strong></td>
<td><strong>80.1</strong></td>
<td><strong>21.1</strong></td>
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</table>
Lexical Retrieval Cascade Treatment
Promoting Self-cueing Strategies

Semantic elaboration

Write word
Oral reading

Write initial letter
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 Self Cue</td>
<td>“Tell me about it.”</td>
<td>“It’s in the kitchen. I use it for pancakes.”</td>
</tr>
<tr>
<td>Orthographic Self Cue</td>
<td>“Can you write any part of the word?”</td>
<td>S</td>
</tr>
<tr>
<td>Phonemic Self Cue</td>
<td>“What sound does that letter make?”</td>
<td>/s/</td>
</tr>
</tbody>
</table>

### Oral Reading
- Provide written name. **spatula**
- “What does this say?”

### Copy
- “Copy the word.”
- “Try to say it.”

### Repetition
- “It’s a spatula.”
- “spatula”
Lexical Retrieval Cascade Treatment

Stimuli – participant selected from standard set of 60 items

20 items selected for tx
Failed ≥ 2 of 3 trials

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

1. Look at picture. Try to say the name.

2. Talk about the picture. Try to say the name.
   “It’s a really big fruit. My family ate them at picnics.”

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.
   “/w/, /w/”

6. Read the written word out loud. Copy it.
   Say it again.
Returning to central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. Is there generalization?
4. How durable is generalization?
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?
Results:

Naming of Targeted Items

average length of tx: 5.5 weeks (4.0-7.5 weeks)
Pre-post treatment naming

Duration: 6 weeks
Achieved 98% accuracy naming trained items

Video Clip

lizard
sunflower

Pre-treatment
Post-treatment
Returning to central questions

1. Are treatment outcomes positive and relatively rapid?
2. **How durable are direct treatment outcomes?**
3. Is there generalization?
4. How durable is generalization?
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?
Long term maintenance of trained items
Returning to central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. **Is there generalization?**
4. How durable is generalization?
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?
Results: Examining generalization

Boston Naming Test: Items named

* Significant change P<.05
Communication Effectiveness: Meaningful Information Score (MIS)

**Scoring system**

**0.5 Points:** Some information provided but insufficient for unfamiliar communication partner to guess target item.
- Target item: “Wreath”
- Sample Response: “You see them at Christmas-time.”

**0.75 Points:** Both semantic and orthographic information provided.
- Sample Response: “You see them at Christmas-time and it starts with “W.”

**1.0 Point:** Enough information provided for communication partner to guess target.
- Sample Response: “You see them at Christmas-time, and hang them on the door. They are circular.”
Improvement in meaningful information conveyed on the Boston Naming Test

Logopenic Variant

Semantic Variant

- Boston Naming Test: Items named
- MIS score
Returning to central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. Is there generalization?
4. **How durable is generalization?**
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?
Maintenance of Trained Lexical Retrieval Skills

- Repetition
- WAB Object Naming
- MMSE

4 months no Tx
4.5 weeks Tx
2 month follow up

P6BLB Logopenic

“Protective” effect of treatment?
Returning to central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. Is there generalization?
4. How durable is generalization?
5. **Does treatment slow the progression of anomia?**
6. What is the perceived benefit?
Naming composite over time
(Boston Naming Test and Arizona Naming Test)

Pre-Tx naming composite
Pre-Tx 2 naming composite
Post-Tx naming composite

P11
P6
P3
P1
P2
Performance on Picture Description Tasks

**Informativeness** - informative words/total words

**Efficiency** - informative words/minute

Significant change in informativeness post Tx, $P<.05$

$n=5$

(Nicholas and Brookshire, 1993)
Can additional improvement be achieved?

- Some participants may be able to benefit from additional treatment to maximize gains achieved with Lexical Retrieval Cascade
- Individuals with milder anomia may need a more challenging “starting point” for treatment
- 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 is challenging!
    - More demands on processes involved in lexical retrieval

- We report on 7 individuals with PPA
  - 4 individuals who proceeded from Lexical Retrieval Cascade Treatment to Generative Naming Treatment
  - 3 individuals who received Generative Naming Treatment only
Four Participants who had completed Lexical Retrieval Cascade Treatment

<table>
<thead>
<tr>
<th></th>
<th>Sex</th>
<th>Age</th>
<th>Time Post Onset</th>
<th>Variant</th>
<th>WAB AQ</th>
<th>BNT</th>
<th>MMSE</th>
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<tbody>
<tr>
<td>P2</td>
<td>JLT</td>
<td>F</td>
<td>67</td>
<td>Logopenic</td>
<td>82.2</td>
<td>13</td>
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<td>JLP</td>
<td>F</td>
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<td>CLW</td>
<td>M</td>
<td>69</td>
<td>Logopenic</td>
<td>80.4</td>
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<td>14</td>
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<tr>
<td>P12</td>
<td>MSR</td>
<td>M</td>
<td>60</td>
<td>Semantic</td>
<td>90.2</td>
<td>19</td>
<td>29</td>
</tr>
</tbody>
</table>

Individual Performance

[Graph showing individual performance of P1 to P13, with blue representing pre and red representing post scores, highlighting participants P2, P10, and P12.]
Participants: Generative Naming Treatment

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

<table>
<thead>
<tr>
<th></th>
<th>Sex</th>
<th>Age</th>
<th>Time Post Onset</th>
<th>Variant</th>
<th>WAB AQ</th>
<th>BNT</th>
<th>MMSE</th>
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<tr>
<td>P2JLT</td>
<td>F</td>
<td>67</td>
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<td>82.2</td>
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<td>88.9</td>
<td>33.7</td>
<td>24.6</td>
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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)
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.

What is it used for?  Where do you find it?  What is it made of?

blender

What is it used for?  Where do you find it?  What is it made of?
Homework

• Sort Pictures into Categories
• Add 1-2 more items/category

Large

Small-Kitchen

Bathroom

Used for Chores

washer
dryer

coffee pot
crock pot

hair dryer

steamer
Results: Generative Naming

Group Performance

Average Items per Category

Pre vs. Post: p < .005

Individual Performance (Trained Categories)

Average Items per Category

P2, P7, P10, P12, P14, P15, P16

Logopenic, Semantic, Logopenic
Results: Examining Generalization

Boston Naming Test

<table>
<thead>
<tr>
<th></th>
<th>Pre Post P2</th>
<th>Pre Post P10</th>
<th>Pre Post P7</th>
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Results: Examining Generalization

Boston Naming Test

- Meaningful Information
- Semantic
- Correct

Pre Post
P2
P10
P7
P12
P14
P15
P16

Logopenic
Semantic
Logopenic
Lexical Retrieval Treatment for PPA: Central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. Is there generalization?
4. How durable is generalization?
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?
Performance on Untrained Tasks

Cognitive Tasks
- MMSE
- Ravens
- WAB
- Naming
- BNT

Lexical Retrieval Tasks

%Correct

Pre-Tx 1 Post Cascade 1 Post Gen 1 3 mo f/u

Pre-Tx 2 Post Cascade 2 Post Gen 2 6 mo f/u

Pre-Tx Post Tx 3 month follow up Pre-Tx Post Tx 6 month follow up

2 Years No Tx

P12MSR Semantic Variant
Returning to central questions

1. Are treatment outcomes positive and relatively rapid?
2. How durable are direct treatment outcomes?
3. Is there generalization?
4. How durable is generalization?
5. Can treatment slow the progression of anomia?
6. What is the perceived benefit?
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?
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

\( X = \text{MG} \)
\( X = \text{HH} \)
\( X = \text{AW} \)
\( X = \text{JT} \)
\( X = \text{JP} \)
\( X = \text{MR} \)
What have we learned?

1. Are outcomes positive and relatively rapid? **YES**
2. Are outcomes durable? **Variable, but YES**
3. Is there generalization? **Variable, but YES**
4. Is generalization durable? **Variable, but YES**
5. Can treatment slow the progression of anomia? **Maybe**
6. Do patients perceive benefit? **YES**

**Is behavioral treatment worth the effort?**

**YES**
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