



# Aphasia Research Center NEWSLETTER University of Maryland

VOLUME 3

FALL 2009

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Every hour, approximately 30 people develop aphasia as a result of stroke and there are about 1 million individuals with aphasia in the United States!

**Aphasia** refers to difficulty in speaking or understanding language due neurological injury, most commonly due to stroke. Aphasia can be debilitating, impairing the ability to communicate effectively, socialize, and return to work.

At the Aphasia Research Center we study speaking and comprehension in individuals with aphasia using different methods, such as language analysis, reaction time measures, grammaticality judgments,

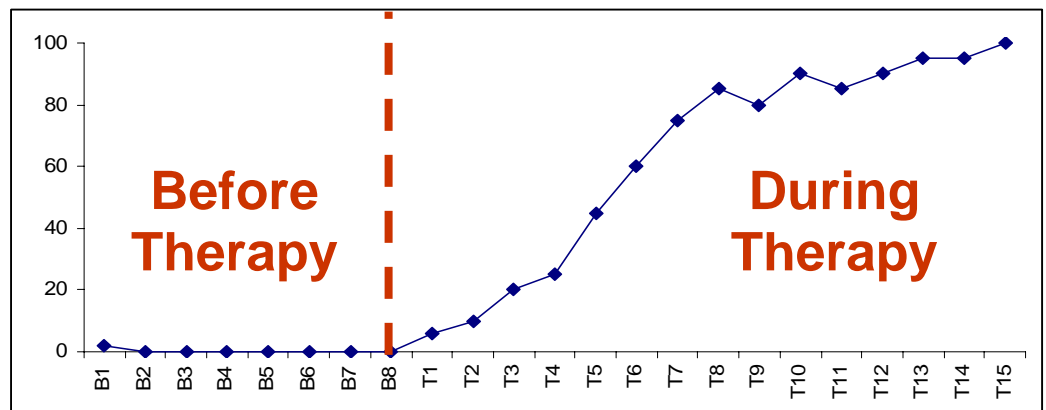
treatment efficacy, and brain imaging. In particular, **we are interested in the following issues:**

- Why do some individuals with aphasia experience difficulty in producing sentences, particularly, verbs in sentences?
- What types of therapy offer the most benefit to individuals with difficulties in verb and/or sentence production?
- What neural mechanisms are involved in understanding and using verbs and sentences?
- What changes in brain function accompany successful therapy outcomes?

## What's new in our lab.

In our lab, professional researchers, doctoral students, speech-language therapists-in-training, and interested undergraduates work on projects to understand the deficits in aphasia and design new treatments. The following pages describe our research findings over the last year as well as our therapy studies currently underway. The figure below shows the progress one participant with aphasia made in producing grammatically correct sentences.

The figure below shows the percentage of sentences correctly produced by one of our participants with aphasia during eight visits before the start of therapy (left portion) and then over the course of fifteen therapy sessions (right portion). See the descriptions of our therapy studies on page 2.



# New Therapy Approaches



A constraint-induced therapy session in progress.

“More than fifteen individuals with aphasia have successfully participated in our various therapy studies.”

A primary focus of our research is developing and testing therapy approaches for individuals with aphasia. We use the findings of our other research studies to learn more about specific deficits and design speech-language therapies to treat them. The therapy studies focus on verbs and sentences and involve intensive individual sessions 3-5 times a week for 2 hours each, and typically extend between 4-6 weeks. The duration of the study for each participant depends on progress made in therapy. More than fifteen individuals with aphasia have successfully participated in our various therapy studies.

One study examined a therapy procedure for **using verbs in sentences**. Another study used **Constraint Induced Aphasia Therapy** to improve sentence production, and yet another study examined a therapy approach for **increased use of verbs**. Overall, we have found considerable success in these novel therapeutic approaches.

The figure on page 1 shows the progress in the ability to produce grammatically accurate sentences in one of our participants over the course of fifteen therapy sessions.

## Words

Our research has uncovered some interesting patterns in how people with and without aphasia understand and produce words.

- Persons with aphasia are more accurate at producing **verb endings** (e.g. *-ed* in *baked*) if they have just heard or seen another verb with the same ending (e.g., *asked*).
- When hearing or reading sentences, some persons with aphasia have difficulty **understanding the time indicated by verb forms**. They may not connect *will* with future time and the *-ed* ending with past time.
- Reading or listening to verbs automatically enacts related actions in our brains (**Embodied Cognition**). Just after reading the word “licking”, people are slower to recognize the word “kissing” because both actions use the lips, and our brains cannot enact two actions with the same body part in quick succession. Individuals with and without aphasia show this pattern. These results will help us improve how we retrain groups of related words for individuals with aphasia.
- Our research supports the idea that the way our brains organize words for actions is more complex than the way they organize words for objects. Our work with a **multilingual** aphasic person indicates that after stroke, verbs can be more difficult than nouns across all the languages that a person speaks. We have also shown that, in some cases, providing **translation cues** in one language can help a multilingual person with aphasia say a verb in another language.

# Brain Imaging Studies

Since aphasia results from injury to the brain, we are interested in the **relationships between brain damage and resulting language deficits**. We want to learn more about changes in neural activity that occur in patients who participate in our novel therapy studies (see figures below). We are using **magnetoencephalography (MEG)** in conjunction with **magnetic resonance imaging (MRI)** for our studies.

The pictures below show a change from very little neural activity before therapy to

increased neural activity after therapy in one of our participants. The overlaid MEG waves below were recorded when our participant was listening to sentences while in the scanner. The red and blue dots in the MRI scan below point to likely brain regions that show increased activity after therapy. Interestingly, we find that the left hemisphere (the side of the brain that experienced the stroke) actively participates in language recovery.

In another study conducted in collaboration with

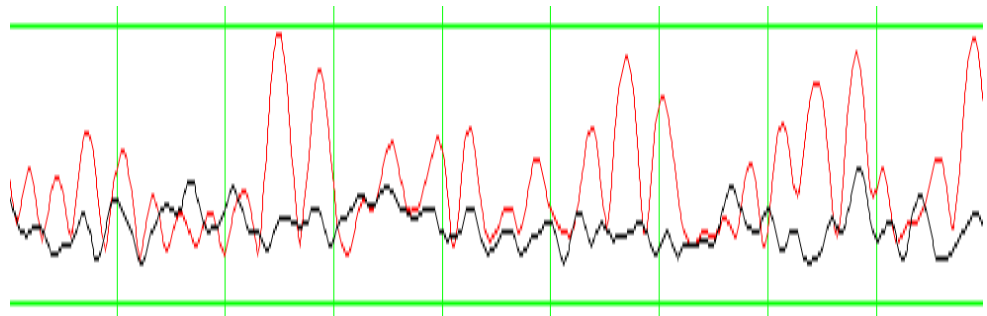
the **National Institutes of Health**, we used a technique called **voxelwise lesion symptom mapping** examined the associations between the location of brain damage and specific difficulties with sounds, words, and sentences. This study supports specialized roles for various brain regions and brings us closer to understanding which regions of the brain work with meaning, grammar, and sound patterns. It helps us in predicting which symptoms are likely to persist in aphasia.

*Another study used MEG to examine how related words are processed by Spanish-English bilinguals.*

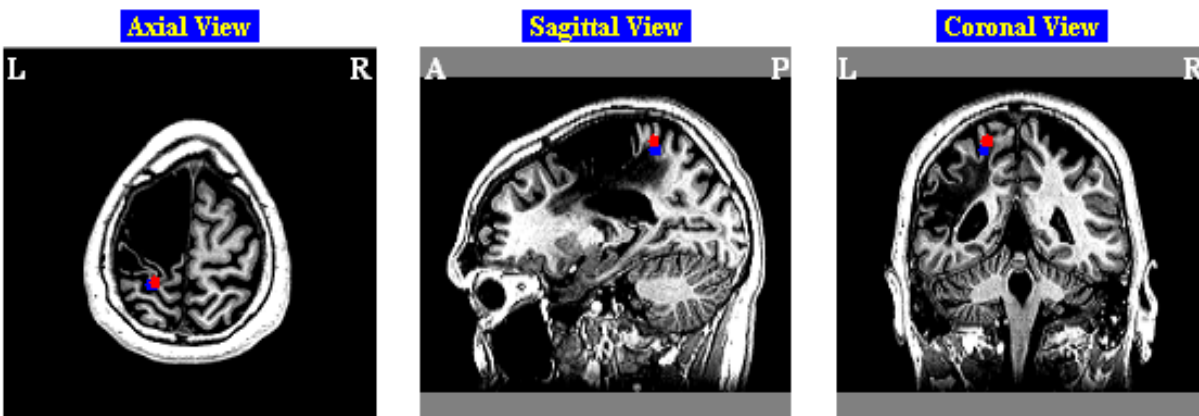
The figure below shows neural activity recorded via magnetoencephalography (MEG) in a participant with aphasia when listening to sentences. The black line was recorded in a pre-therapy session and the red line was recorded after the completion of a course of therapy.

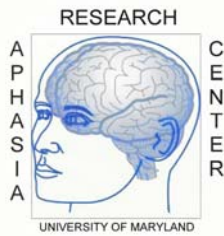
**Black Line:**  
**Before Therapy**

**Red Line:**  
**After Therapy**



The figures below show magnetic resonance brain images (MRI) of one of our participants with aphasia. The colored dots indicate areas that appear to increase their activity as a result of therapy.





## Aphasia Research Center

### Director

Yasmeen F. Shah, PhD, CCC-SLP  
Department of Hearing & Speech Sciences  
University of Maryland

### Contact

E-mail: [aphasia@hesp.umd.edu](mailto:aphasia@hesp.umd.edu)  
Web: [http://www.bsos.umd.edu/hesp/  
facultyStaff/shahy/lab.htm](http://www.bsos.umd.edu/hesp/facultyStaff/shahy/lab.htm)  
Phone: 301-405-2477

## Interested in Participating?

We are always interested in involving more **individuals with aphasia** in our research. So, if you or anyone you know has had a stroke and is experiencing difficulty with speaking or understanding language, please contact us. We provide a speech-language evaluation and therapy free of charge for eligible participants. Transportation expenses are reimbursed.

We also recruit **individuals without aphasia who are in the same age range** as our aphasic participants for comparison purposes. So if you do not have aphasia or any other neurological conditions, please contact us for more information. Most testing is conducted at the Aphasia Research Center in College Park. However, depending on availability of personnel, we may be able to make an initial home visit.

## Upcoming Events

### Academy of Aphasia, Boston, Oct. 18-20, 2009

Voxel-based Lesion Analysis of Phonological, Lexical, and Syntactic Production Deficits in Post-stroke Aphasia  
*Faroqi-Shah, Y., Kling, T., Solomon, J., Archibald, J., Park, G., Braun, A.*

Tomato to Baritood:

The Source of Non-Words in Jargon Aphasia  
*Sampson, M., Faroqi-Shah, Y.*

### American Speech-Language and Hearing Association, New Orleans, Nov. 19-21, 2009

Monitoring of Self-Generated Speech in Jargon Aphasia  
*Sampson, M., Faroqi-Shah, Y.*

### Undergraduate Honors Thesis Defense, Dec. 2, 2009

Single-word Processing in Bilinguals:  
A Neuroimaging Investigation  
*Pyun, L.*

University of Maryland, College Park (BPS 1208)

### Maryland Stroke Alliance Annual Meeting, Nov 7, 2009 at 2:00 pm

Aphasia Rehabilitation: The State of the Science  
*Faroqi-Shah, Y.*  
The Westin, Annapolis, MD

