**Profiling language skills, executive functions, and life satisfaction in three individuals with aphasia**

## Introduction

A recent trend in aphasia research is to examine the impact cognitive impairments may have on individuals with aphasia. Recent studies have examined the development of appropriate cognitive assessment batteries for individuals with aphasia (Keil and Kaszniak, 2002, Murray and Ramage, 2000), the relationship between cognitive impairments and functional communication skills (Fridriksson, et. al, 2006) and the effect of cognitive impairments on response to treatment in individuals with aphasia (Fillingham, et. al, 2005 Ramsberger, 2005 and Hinckley and Carr, 2001). One particular focus of research has been to examine executive function skills (Nicholas, Sinotte, Helm-Estabrooks, 2005, Fridriksson et. al, 2006).

Executive function skills (EF) have been defined in a number of different ways. Some researchers include executive functions as part of a cognitive system that receives input from lower processes and sends output to higher processes (Stuss, 1991). Others view executive functions as one layer in a cognitive system that includes such skills as working memory and attention. (Keil and Kasniak, 2002). Regardless of the viewpoint, executive functions are thought to play a role in four key aspects of meaningful actions: 1. volition, 2. planning, 3. purposive action and 4. effective performance (Lezak, et. al, 2004). A breakdown in any of the components of executive functions may negatively impact an individual's ability to appropriately engage in a multitude of functional activities.

The purpose of the current study was to provide preliminary data on the nature of language and EF impairment in three individuals with aphasia. Formal test data were used to profile strengths and weaknesses and the effect on functional communication. In addition, each individual's level of participation in daily life activities was rated and the impact of language and EF impairments on life satisfaction estimated. It was hypothesized that relatively intact EF skills may facilitate compensation and life satisfaction following onset of aphasia.

## Method

*Participants*

Three participants were enrolled in the current study. In addition to formal evaluation, each individual was observed during weekly individual and group treatment sessions to document functional communication in varied contexts.

The first participant, PM, a 63 year old male, suffered a left MCA infarction with hemorrhagic conversion in October, 2005. He was a retired telephone company engineer and a Navy veteran. He demonstrated a moderate to severe Broca's aphasia. His phrase length was one, however, infrequent use of three to four word phrases was observed. He presented the stereotypy "tucumsa". In functional communication settings, PM relied on verbal utterances as his primary mode of communication. Writing and gesturing were not successful alternatives. Daily activities included "field trips" with his caregiver in which

he would choose from three possibilities. Examples of such "trips" included museums, local farm stands, and the movies. PM never requested an outing spontaneously.

The second participant, MP, a 64 year old male, suffered a left temporoparietal infarct in May 1999. Prior to his stroke, he managed an auto repair service and was an Air Force veteran. He demonstrated a moderate to severe Broca's type aphasia with a phrase length of one. MP's primary mode of communication was inconsistently successful verbal utterances; however, gestures were somewhat effective. In addition, MP had a high tech AAC device which he used solely for language stimulation. His primary home activity was watching television. His wife reported that he rarely initiated interactions with anyone other than herself.

The third participant, PS, a 68 year old male, suffered a left hemisphere ischemic stroke in August, 2005. Prior to his stroke, he was a mold maker for a local tool factory. He demonstrated a moderate Broca's aphasia with a phrase length of two to three. PS used a variety of modalities to express his ideas including verbal, gesture, writing and a high tech AAC device. No one modality was more effective; however, the combination of modalities allowed him to communicate simple ideas effectively. He and his wife reported that he continued to do the majority of driving, managed the bills and investments for his family and enjoyed occasional day trips to a local casino.

*Formal Testing*

Each individual underwent 4 – 6 hours of testing. Each test was administered in one session for a total of four individual sessions. Breaks were provided as needed. Formal testing included the Aphasia Quotient (AQ) of the Western Aphasia Battery, the Ravens Standard Progressive Matrices (RSPM) (tests nonverbal problem solving and reasoning) and the following subtests of the Delis-Kaplan Executive Function System (D-KEFS): Trail Making Test (test visual scanning and response switching), Design Fluency Test (tests formulation of new responses, awareness of errors, rule learning, response inhibition and switching), and the Tower Test (tests spatial planning, rule learning, inhibition of impulsive and perseverative responses, and establishment and maintenance of cognitive set). The subtests of the DKEFS and the RSPM were selected because they were judged to sample abilities critical for compensating for aphasia and their low linguistic load.

(Refer to Figures 1, 2 and 3 for test scores for all participants)

In addition, each individual was administered the Burden of Stroke Scale (BOSS) (Doyle et. al, 2004) in order to capture the impact stroke may have had on functional activities and life satisfaction.

(Refer to Figure 4 for ratings for all participants)

**Data analyses**

Nature and severity of executive function impairments were analyzed based on comparison of tested skills and level of performance. In addition, formal test results were

evaluated against participant ratings' on the BOSS in order to compare severity of impairments to life participation.

## Results

### *Performance Profiles*

#### *PM*

Of the three participants, PM presented the greatest impairment in language skills (AQ = 33.6) and the least impairment in EF skills. He was able to establish and maintain a cognitive set, switch between response modalities and learn new rules. PM demonstrated difficulty inhibiting perseverative responses. He considered his communication difficulties to be the primary cause of decreased life participation. These difficulties did not discourage him from relating to friends and family or entering new social situations. He reported a positive mood with good life satisfaction. PM's profile appeared to support the study's hypothesis.

#### *MP*

MP presented moderate-severe impairments in language (AQ= 43.2) and EF skills. Throughout all testing, MP demonstrated substantial difficulty learning new rule sets and establishing and maintaining cognitive sets. Although his overall response accuracy was poor and he was not consistently aware of his errors, they were seldom perseverative. In terms of life participation, MP considered communication and difficulty engaging in social situations as his greatest burdens to life participation. He reported lower mood ratings in all domains. MP's profile also appeared to support the study's hypothesis.

#### *PS*

PS presented the mildest language impairment (AQ= 59.5) and moderate EF deficits. His responses were often impulsive. He was able to self-correct his errors 50% of the time. PS reported that communication difficulties often prevented him from participating in social activities he used to enjoy. These changes in life participation, however, did not negatively impact his overall mood, satisfaction or restriction in other activities post stroke. It would appear that PS's profile also supported the study's hypothesis.

## Discussion

The following issues will be discussed:

1. Potential relationship between executive functions and functional communication skills.
2. Potential relationship between executive functions and life satisfaction.
3. Treatment implications for individuals with EF deficits and aphasia.

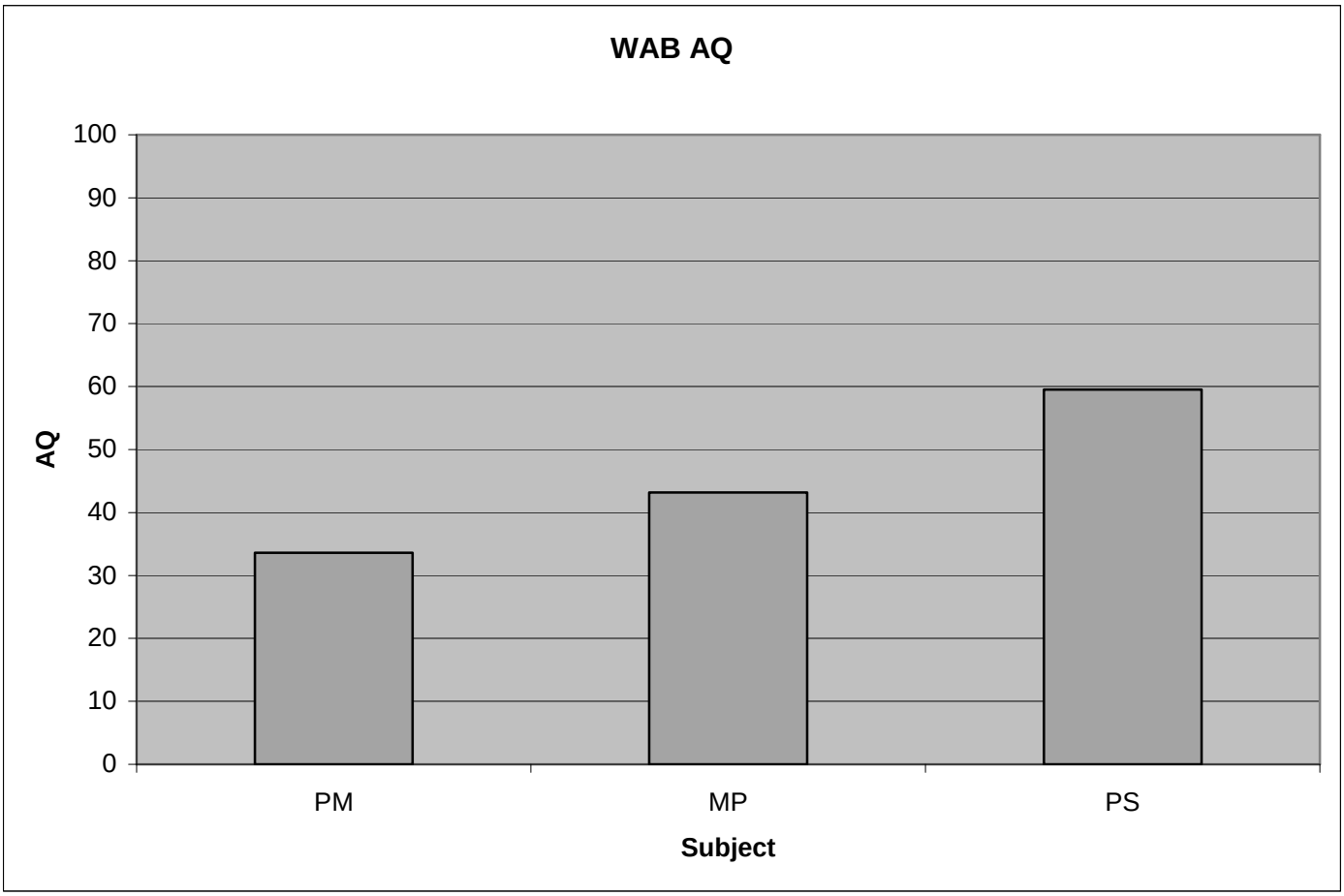


Figure 1. Western Aphasia Battery Aphasia Quotient

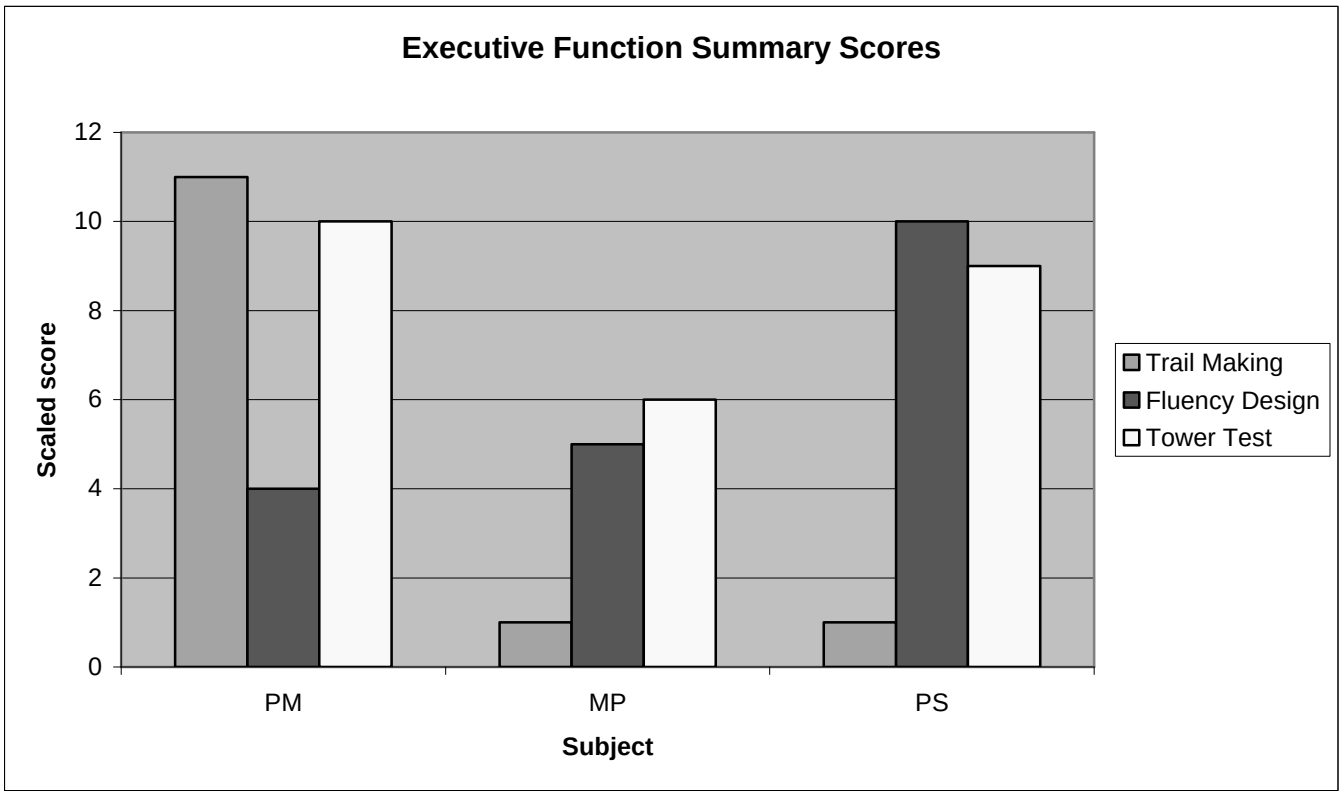


Figure 2. Delis Kaplan Executive Function Scale standard scores per subtest. (The higher the standard score, the fewer errors made)

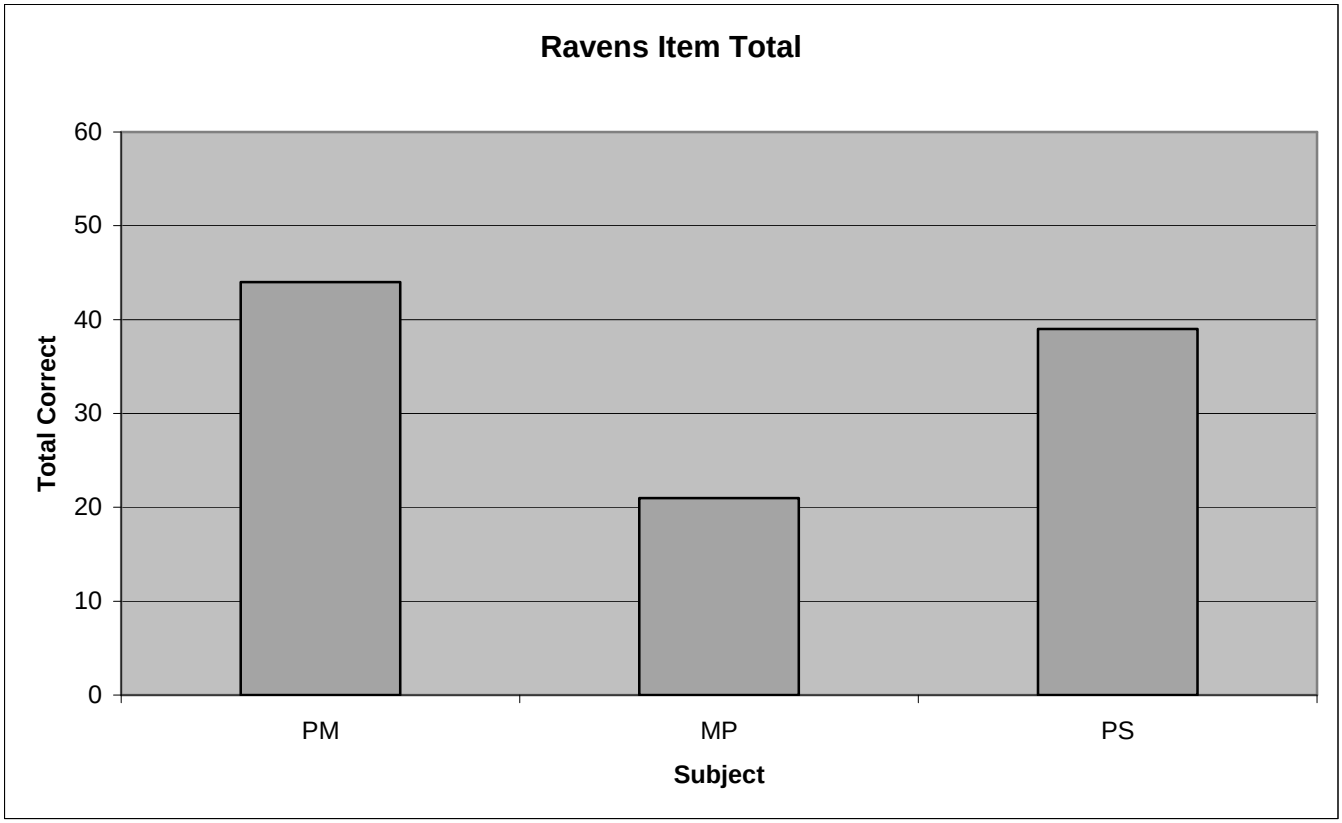


Figure 3. Ravens Standard Progressive Matrices total item scores.

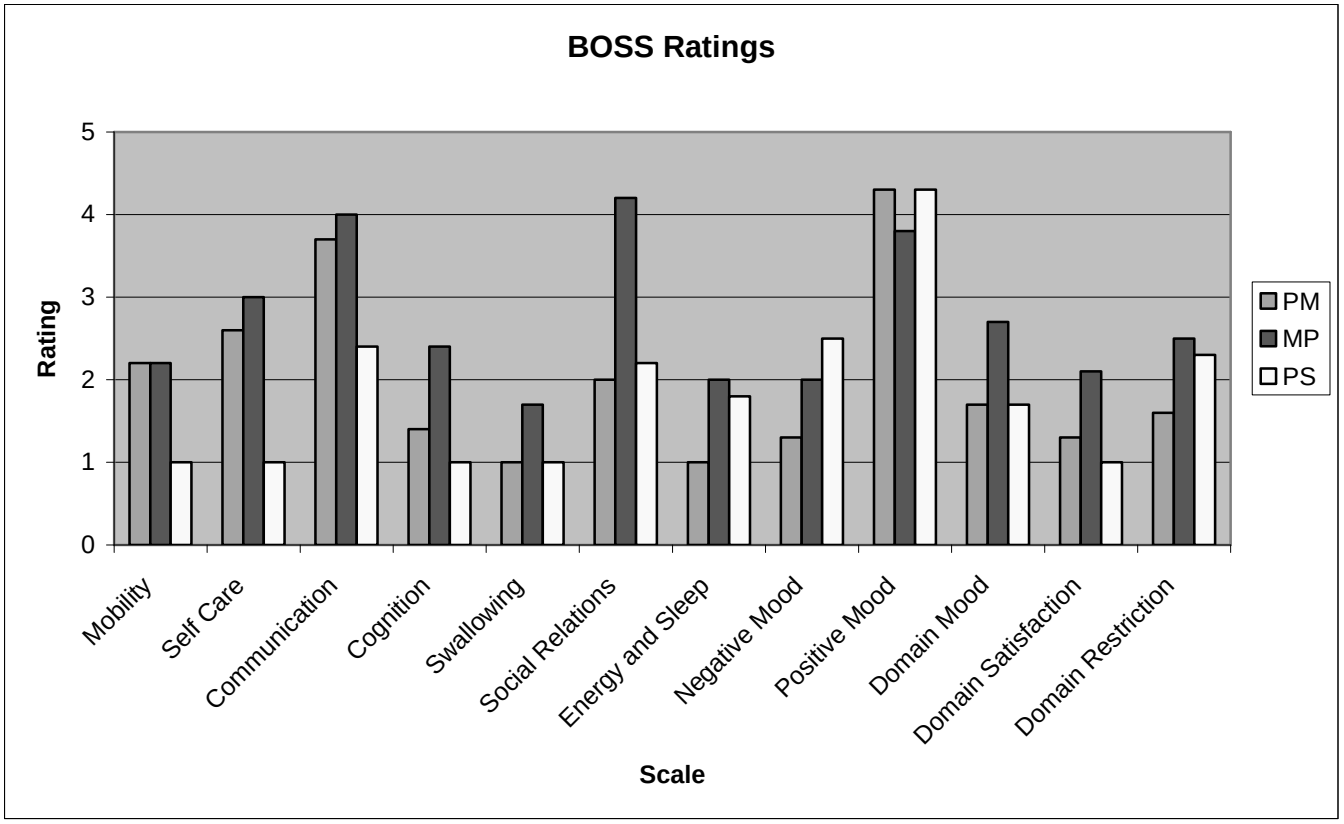


Figure 4. Burden of Stroke Scale scores. (Score for each subtest is an average rating for items within each subtest. For Mobility through Energy and Sleep, a higher score indicates a greater impact of the stroke. For Negative Mood and Positive Mood, a higher number indicates more negative or positive feelings the person experiences overall. For Domain Mood, Satisfaction, and Restriction a lower number indicates a more positive mood, better satisfaction or less restriction.)

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