The Boston Naming Test (BNT; Kaplan, Goodglass, & Weintraub, 1983) is considered the gold standard of naming assessments in speech-pathology and is commonly used to diagnose and assess aphasia and dementia. In addition to the full 60-item test, several short-form versions have been created (Calero, Arnedo, Navarro, Ruiz-Pedrosa, & Carnero, 2002; Fastenau, Denburg, & Mauer, 1998; Fisher, Tierney, Snow, & Szalai, 1999; Franzen, Haut, Rankin, & Keefover, 1995; Graves, Bezeau, Fogarty, & Blair, 2004; Lansing, Ivnik, Cullum, & Randolph, 1999; Mack, Freed, Williams, & Henderson, 1992;Saxton, Ratcliff, Munro, Coffey, Beck, Fried, & Kuller, 2000; Tombaugh & Hubley, 1997; Williams, Mack, & Henderson, 1989). The creation of the full 60-item BNT and the majority of the shortened versions employed traditional standardization methods of classical test theory. Standardization is performed on the test as a whole rather than on the individual items, without attention to the difficulty level of items. Although item statistics can be generated post hoc, they apply only to that group of subjects on that collection of items. Rasch analysis however takes advantage of recent advances in psychometrics, that allow for the analysis of instruments at the item level. Item response theory claims that the probability of a person's response to an item is the combined function of that person's ability and the difficulty level of the item (Bond & Fox, 2001).

One of the shorted forms of the BNT employed Rasch analysis (Graves et al, 2004; Bond & Fox, 2001) to responses from neurologically-healthy individuals and individuals diagnosed with various forms of dementia. However, considering the differences in underlying mechanisms of anomia for dementia compared with aphasia, it is not known if this particular short form is valid for use with individuals with aphasia. Thus, this study addressed 2 aims: 1) to determine if the existing 15-item short form based on Rasch (Graves, Bezeau, Fogarty, & Blair, 2004) is valid in the aphasia population and 2) based on the outcomes, the secondary aim is to create a 15-item short form using the data from individuals with aphasia.

## Methods

### Participants

Archival data from the VA Brain Rehabilitation Research Center (BRRC) was used to examine BNT (Kaplan, Goodglass, & Weintraub, 1983) performance of 50 individuals (29 males, 21 females) diagnosed with aphasia (Western Aphasia Battery (WAB; Kertesz, 1982). All individuals had a left hemisphere stroke at least 6 months prior to examination and were right-handed, monolingual, English-speakers. Participants' characteristics are displayed in table 1.

*Phase 1: Applying the Graves et al. (2004) short form to aphasia*

Aim 1 Procedures: All participants were given the full 60 item BNT by a licensed speech-pathologist following original directions for administration and scoring. Only spontaneous responses without cueing were used in the current study. Participant responses were analyzed with the WINSTEPS Rasch analysis computer program. Infit mean squares greater than or equal to 1.4 and Outfit mean squares greater than or equal to 2.0 were considered to misfit. Rasch analysis was computed on the 15 items from the Graves (2004) short form using the responses of 50 individuals with aphasia.

Aim 1 Results: Analysis was completed on 35 of 50 participants (15 participants were excluded by the Rasch program because total scores were zero or one resulting in insufficient data for the analysis). The range of person ability and item difficulty was between -3 and 3 logits. Only one participant misfit according to Infit mean square criteria and three participants misfit by Outfit

mean square. No items misfit. Based on the real RMSE, person separation is 1.48 and the number of strata is 2. Person and item reliability are .69 and .77, respectively. The items have relatively retained their hierarchy according to frequency, seen in figure 1 as items with higher item number near the top and those with lower item number near the bottom.
Aim 1 Discussion: Results of the 15 item analysis indicates that some of the items are not appropriate for this population based on differences between the difficulty level of the test and the ability level of the participants. Several items are functioning at the same difficulty level, seen as items in the same line in Figure 1. The mean difficulty of the items is greater than the ability of the participants. In addition, 15 participants were dropped from the analysis because they did not get any of these items correct suggesting easier items are required for this population. Thus, there was motivation to create a short form better suited for individuals with aphasia.

*Phase 2: Creating a short-form BNT for individuals with Aphasia using Rasch analysis*
Aim 2 Procedures: While there were weaknesses in the application of the Graves et al., (2004) short form to the aphasia data several items fit the ability of the participants and fell appropriately in the hierarchy. Therefore, it was decided to keep items from the Graves et al., (2004) short form with acceptable Infit and Outfit criteria that did not overlap, resulting in eight items. When items did overlap the item with the best Infit and Outfit criteria were kept, this added two items. Four high frequency (easier) items were added from the original 60. Lastly, one item was added at the more difficult end of the scale to close the gap present in the Graves et al., (2004) short form.
Aim 2 Results: Rasch Analysis was completed on 39 of 50 participants (11 participants were excluded by the Rasch program because of total scores of one or zero which provides inadequate data to analyze). The range of person ability and item difficulty was between -4 and 4 logits. Six participants misfit according to Infit mean square and Outfit mean square. No items misfit according to Infit and two items misfit on Outfit mean square. Using the real RMSE, person separation has increased to 1.95 increasing the number of strata to 3. Person and item reliability have also increased to .79 and .92, respectively. These values are based on the 39 participants who could answer more than one item. However, more impaired cases of aphasia usually involve motor deficits of the speech articulators further complicating the ability to verbally name a picture. Thus, it may be acceptable for persons with aphasia to get a score of zero. Using the values associated with the total 50 participants, person separation is 2.13, person reliability is .82 and item reliability is .92. As seen in the previous 15 item short form, the items have preserved their hierarchy (Figure 2). The mean difficulty of the items is nearly equivalent to the ability level of the participants, an improvement from the phase 1 short form.
Aim 2 Discussion: This short form, using ten items from the Graves et al., (2004) form and 5 new items provides a wider range of difficulty necessary for the range of impairment in the aphasia population. The current short form should be re-analyzed with Rasch using a larger set of responses from individuals with aphasia. Additionally, Rasch analysis should be applied to the BNT using a rating scale scoring system to include the use of semantic and phonologic cues. Such an analysis will provide the Rasch model with additional information of each participant's ability allowing a more fine-grained comparison to the test's difficulty.

Table 1. Participant characteristics

| | **Age** | **Months Post Onset of Stroke** | **Education** | **WAB AQ** | **BNT (spontaneous correct)** |
|---|---|---|---|---|---|
| **Average (SD)** | 63.7 (11.9) | 41.7 (44.0) | 13.4 (3.5) | 60.9 (25.5) | 22.4 (16.9) |

Figure 1. Map of 15 items from Graves et al. (2004) with Aphasia Data

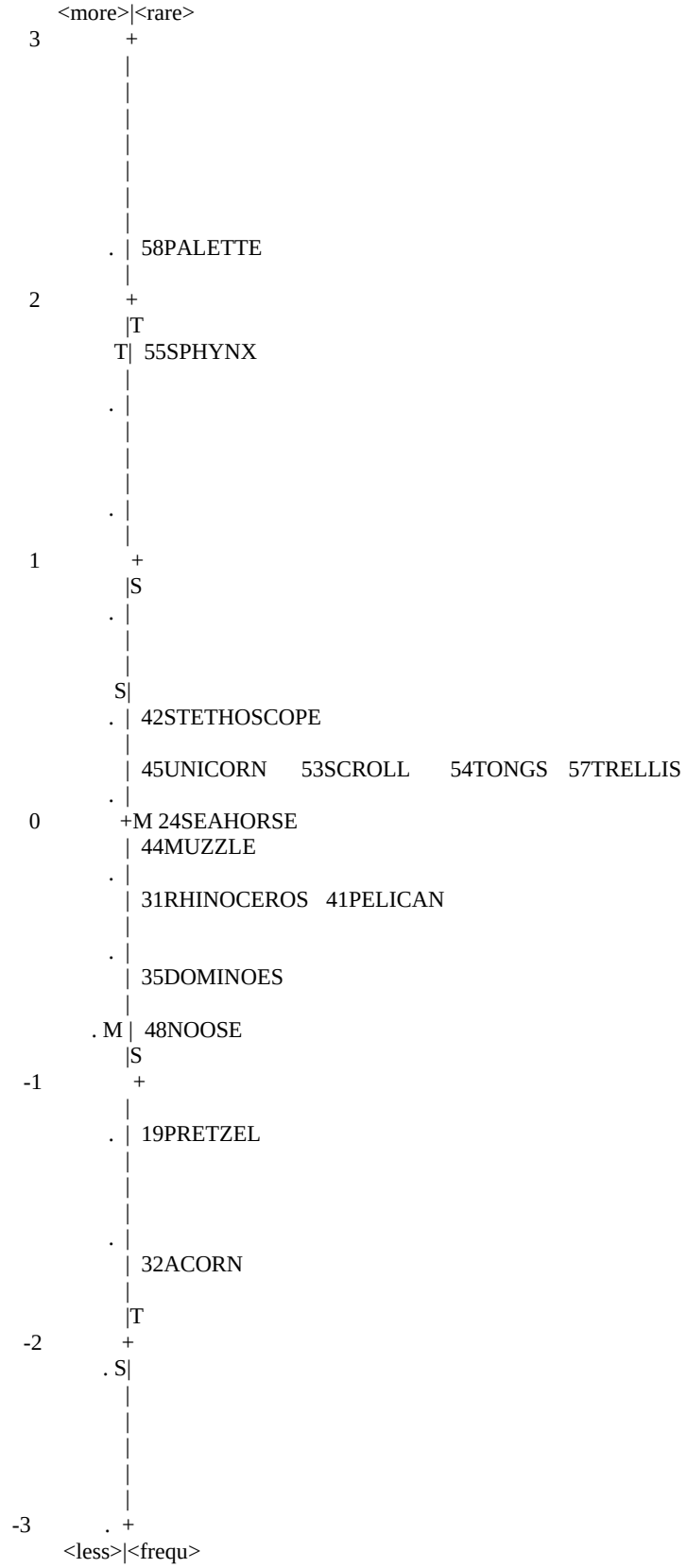
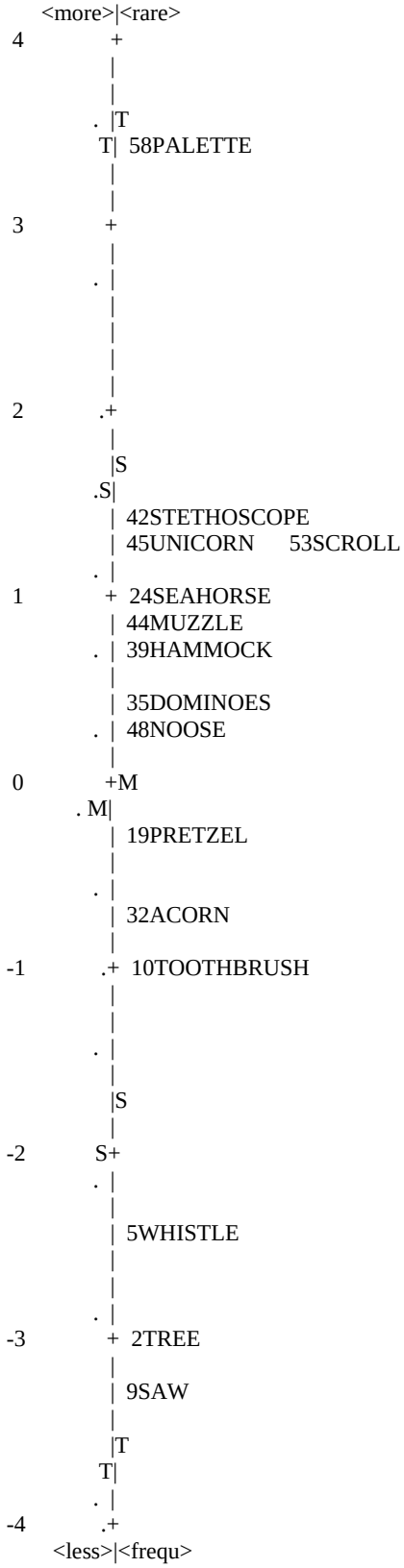


Figure 2. Map of 15 ITEMS with Aphasia data



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