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Normative Data for the Poreh Naming Test

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ABSTRACT

The present study describes the development of a novel confrontational naming test for the assessment of word finding and language abilities, and also serves as a tool for the assessment of effort. The test is comprised of two portions. The first portion consists of 40 colored drawings of day to day objects and is aimed at assessing verbal abilities, particularly word finding deficits. The second portion also involves the presentation of 40 colored drawings, each drawing comprised of the original object that was previously presented and two distractors, objects that were not previously presented. The present study aims to evaluate the reliability and validity of this new measure in addition to providing preliminary normative data, and analyze the relationship between test performance and variables that have been shown to influence naming ability. The study shows that the new test might be useful for assessing both language abilities and effort.

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CHAPTER I

INTRODUCTION

Word finding deficits, or anomia, are nearly always a component of aphasia and are associated with dementia or cognitive impairment (Rohrer et al., 2008). For decades, The Boston Naming Test (BNT), developed by Kaplan, Goodglass, and Weintraub (1983), has been the gold standard instrument for assessment of visual confrontation naming or, in simpler terms, detection of naming deficits. The test was originally developed in the 1970s and has served clinicians and researchers ever since, without any attempt to update the test items.

For example, one of the items used in the Boston Naming Test is a picture of a yoke, a more common object in the 1950s, but which is rarely encountered by the general population. Another item is the word "abacus," a Chinese hand calculator. The ability to correctly name this item is more likely to be the reflection of level of education, age and intelligence than having a word finding impairment. Similar critic has also been leveled in the literature. Hawkins et al., (1993) and Kilgore and Adams, (1999) noted, almost two decades ago, the Boston Naming Test includes numerous low-frequency words. Consequently, individuals with a more advanced vocabulary (and hence verbal intelligence) may have an advantage. Indeed, a number of studies show that the BNT has been found to be positively biased toward those with higher education, and consequently biased against those of lower socioeconomic status (Hawkins et al., 1993; Randolph et al., 1999). Evidence also shows that the BNT is gender and racially biased (Randolph et al., 1999).

Furthermore, the black and white images used for the BNT are enigmatic and can hinder item recognition. The BNT provides no advantages for finishing an item promptly and no consequences for slow reaction times, even though slow reaction times are associated with aging (Tsang & Lee, 2001). In addition to the criticisms mentioned, clinicians seem to disagree on how to administer and score the BNT due to the vagueness of the administration instructions provided by the manual (Bortnik et al., 2013).

The improvement of the BNT is a necessary endeavor because it plays a significant a central role in language assessment and particularly in the detection of anomia, aphasia, cognitive impairment, and dementia in a world with an increasing life-span. Previously, a new measure was developed to ameliorate the above problems. This new measure, the Poreh Naming Test or PNT (Poreh, 2009) is aimed at improving the detection of anomia in several ways. First, the PNT is computer-based, which can help to enhance standardization between administrations. Second, the images are colorful and less ambiguous than the black and white images of the BNT. Third, latency can be accurately measured and accounted for. Finally, the items included in the PNT are not low-frequency words, but may be considered more difficult to verbalize. These improvements were implemented help to minimize error between administrations and create a purer measure of naming ability. Below is a more detailed summary of the literature regarding confrontational naming assessment, the limitations of the Boston Naming Test, Assessment of response bias, and the goals of the present study.

1.1 Background on the Boston Naming Test

The BNT is a heavily researched psychometric tool that is used to study word finding in normal populations and to discover word finding difficulties in populations with neurodegenerative diseases. For administration of the BNT, examinees are presented with a line drawing of an object that they are required to provide the name of before 20 seconds has lapsed. Semantic and phonemic cues are given to struggling participants along with extra time (Kaplan, Goodglass, & Weintraub, 1983).

The 1983 version of the BNT has been criticized for having relatively weak psychometric properties. The normative data for the first edition was based on a small and age-restricted sample size (Nicholas et al., 1989). Later, Van Gorp, Satz, Kiersch, and Henry (1986) provided further normative data that focused on older adults. Despite this, quantitative information on the BNT was still inadequate. Nicholas et al. (1989) improved upon the available data by providing standard administration, item-level data, interjudge, and intrajudge reliability. It appears that the BNT has not been improved upon since the work of Nicholas et al. (1989).

1.2 Variables Related to Performance on the BNT

While the BNT is among of the most heavily used neuropsychological tests, it may not be reaching its full potential as a measure of confrontation naming ability (Bortnik et al., 2013). Numerous studies have presented the inherent weaknesses of the BNT. Improvement of the BNT should reduce biases and design flaws to result in more specific and sensitive assessment of naming ability.

Hawkins & Bender (2002) completed a review of the BNT literature. The review revealed that few normative studies of the BNT have reflected the population from which the findings are applied. Therefore, many studies that have found no relationship between variables like education or vocabulary and BNT performance, may not have used optimal research methods. Despite this, many studies have found a relationship between BNT performance and variables that should be unrelated to naming ability.

The relationship between abbreviated BNT scores, race, and health was examined by Whitfield et al. (2000). Researchers included two racial categories (African American and European American) in their analysis. African Americans were found to successfully name significantly fewer items than European Americans.

Vocabulary and education level were found to be correlated with BNT scores in a study conducted by Hawkins et al. (1993). 97 psychiatric patients and 26 normal controls composed the sample. Vocabulary had the strongest relationship with BNT performance (Hawkins et al., 1993). Differences in BNT scores were found between the psychiatric groups and the control group. Those differences were explainable by vocabulary level rather than by diagnosis (Hawkins et al., 1993)

Vocabulary was found to be a predictor of BNT performance in an additional study conducted by Killgore & Adams (1999). This relationship was found in a sample of 62 outpatients with no signs of brain damage. These participants were compared to 23 brain damaged individuals. By adjusting for vocabulary level, Killgore & Adams (1999) were able to show that test specificity was significantly better than when using the established norms. The results of this study show that misdiagnosis is less likely when taking vocabulary ability into account.

Randolph, Lansing, Ivnik, Cullum, and Hermann (1999) found education to be positively correlated with BNT performance. The study included 719 normal controls, 325 participants with Alzheimer's disease (AD) and 87 with temporal lobe epilepsy. Each group showed better performance with higher education. Men scored significantly higher on 18 items and women scored higher on 4 items, showing a disproportionate amount of gender bias on the BNT (Randolph et al., 1999).

Another study, conducted by Hall, Vo, Johnson, Wiechmann, and Bryant (2012), also found gender differences. The total sample consisted of 468 participants (153 with "probable" AD and 318 normal controls). Out of the AD sample, 82 were male and 71 were female. In the control group, 110 were male and 208 were female (Hall et al, 2012). After controlling for age, estimated IQ, education, and a few health related factors, males performed better than females in both the control and AD group. Education was evaluated as an indicator of performance, but no effect was found. Hall et al. (2012) speculated this to be due to the restricted range of education found in the sample.

The impact of age, education, and living environment on BNT scores was analyzed by Neils et al. (1995). 323 male and female older adults contributed data to this study. 167 participants were living on their own while the rest were living in some form of institution for the elderly (Neils et al., 1995). The variables education, age, and living environment all showed significant relationships with BNT performance. A positive relationship was found for education, while BNT score, living environment, and age were negatively related (Neils et al., 1995). That is, while age increased, BNT scores decreased; those living on their own performed better than those living in an institution.

Kavé, Knafo, and Gilboa (2010) examined the role of age in naming performance in a large sample of Hebrew-speakers. Results of the study showed that naming accuracy grew during childhood, but declined in old age. However, analysis also revealed that adult naming was better than childhood naming capacity, which reflects the role of vocabulary in naming.

MacKay, Connor and Storandt (2004) also found a relationship between age and BNT score in normal control subjects. Tsang and Lee (2001) found that age was associated with accuracy and latency. Older subjects were slower to respond and less accurate than younger subjects. This suggests that latency, in addition to accuracy, should be considered in measurement of confrontational naming.

Ostergaurd and Davidoff (1985) compared latencies for colored images versus black and white images. Response time is significantly faster for colored images. Zannino et al. (2010) similarly found that colored line drawings are more accurately named than black and white line drawings by both Alzheimer's disease (AD) participants and normal controls. This effect was even more pronounced in the AD group.

A survey study conducted in 2005 revealed a disagreement among experienced clinicians on proper administration and interpretation of the BNT (Bortnik et al., 2013). The sample reported using norms from four different sources. Scoring was not unitary among clinicians in regards to reversal and discontinuation rules (Bortnik et al., 2013). Ethnicity was not taken into interpretative consideration for more than half of respondents. Scores of patients whose second language is English were interpreted the same for those whose first language is English in 41% of the sample. 30% reported not considering education as an influential factor (Bortnik et al., 2013).

1.3 Clinical Relevance of Visual Confrontation Naming Performance

Object naming can be an indication of any number of cognitive deficits. Even though there are imaging techniques to detect dementia, it's typically up to clinicians to diagnose dementia (Rohrer et al., 2008). As a result, detecting word finding impairment is often an essential aspect of diagnosing dementia. Word finding difficulty is a main complaint in progressive aphasias, therefore it is important to accurately distinguish between word-finding difficulties experienced by the normal population and those that are caused by pathology (Rohrer et al., 2008).

Word-finding problems do occur normally and there is variation in word-finding ability. Word finding has been shown to be influenced by fatigue, anxiety, or mood disorders; this emphasizes the importance of considering process when assessing word-finding. Anomia serves as a prominent aspect of AD and instruments like the BNT are especially important when word-finding is not a major complaint (Rohrer et al., 2008).

Naming is a complex process that involves perception, memory, proper semantic associations, verbal ability, and episodic memory. It is associated with AD and other dementias, semantic memory deficits, and deficits in verbal fluency which are associated with executive dysfunction and frontal lobe damage. Verbal fluency is also related to problems with verbal knowledge memory. Verbal fluency tasks may be helpful in differentiating between progressive aphasias and other degenerative diseases (Rohrer et al., 2008).

Progressive aphasia (PA) is a type of aphasia in which the individual has language problems, but no other deficits. Mendez, Clark, Shapira, & Cummings (2003) studied healthy controls, individuals with AD, and individuals with PA. Results showed anomia to be present in both AD and PA groups but not healthy controls.

According to Kertesz & Harciarek (2014) non-fluent primary progressive aphasia (nfvPPA) is associated with anomia, damage to the left inferior, opercular, and insular regions are indicated with this type of aphasia. In semantic variant primary progressive aphasia (svPPA) one of the main language impairments involves naming. SvPPA is associated with damage to the anterior regions of the temporal lobes, usually more apparent on the left side. Naming is slightly affected for logopenic variant primary progressive aphasia (lvPPA); this aphasia is associated with damage to the temporal and parietal junction on the left side.

Abrahams et al. (2003) conducted an fMRI study of verbal fluency and confrontation naming. This study used items adapted from the BNT to assess activation in 18 healthy participants. For confrontation naming, the researchers found significant activation in left inferior frontal gyrus, middle and inferior occipital gyri, and inferior temporal gyrus. A significant relationship between greater age and high activation in anterior cingulate gyrus and middle frontal gyrus was found. For verbal fluency tasks Abrahams et al. (2003) found significant activity in the left middle frontal gyrus, inferior frontal gyrus, anterior cingulate gyrus, and medial prefrontal cortex.

As demonstrated by the literature, confrontation naming and verbal fluency tasks can reveal information about structural or anatomical damage. As such, these tasks are important clinical tools. Therefore, it would be beneficial to continually improve upon tasks such as the BNT.

1.4 Malingering

Malingering is defined as faking or exaggerating symptoms of a physical or psychiatric disorder. Interest in malingerers and assessment of the phenomena has grown over the years (Nies & Sweet, 1994; Berry & Nelson, 2010). Conceptualization of malingering often includes an external gain to be had (i.e., personal injury suits, workers compensation, medical malpractice, and criminal legal cases). Therefore, pressure from the legal system for accurate detection of malingering has ensued (Nies & Sweet, 1994).

A number of measures to differentiate effort (malingerers from non-malingerers) have been developed and validated over the years. One of the most widely used measures used for assessing effort is the Test of Memory Malingering (TOMM). The test is comprised of 50 pictures which are presented to the subjects. Immediately after the presentation the subject is presented with pairs of pictures, one of which was previously presented. The subject is then asked to identify the picture they previously saw. The task appears extremely difficult considering the number of items, yet because it is not impacted by memory, as this is a task that assesses procedural memory, subjects with genuine memory problems obtain almost perfect scores on the memory portion of this test. When the test is administered, after randomizing the order of the pictures both at the presentation and recognition portions of the test, most subjects obtain a perfect score (Teichner & Wagner, 2003).

Another very popular measure for the assessment of effort is the Reliable Digit Span Index, a computational index of the Digit Span Test originally developed by Yerkes (1917) and later adapted by David Wechsler as part of his intelligence test (Wechsler, 2008). The Reliable Digit Span Index was first described by Greiffenstein, Baker, and

Gola (1994). They showed that this index is sensitive in detecting response in subjects who apply for disability or are in litigation and where identified as malingerers by measures such as the TOMM. Participants are required to repeat strings of numbers. A score of 7 or less serves as an indication of probable malingering (Meyers & Volbrecht, 1998).

Given that the TOMM is a sort of a confrontation naming test, combining it with the BNT methodology will shorten the assessment process and improve the examiner's ability to distinguish between language and bona fide memory deficits. Additionally, unlike the TOMMM, the test presented in the present study will include two distracter items instead of one. This might decrease the likelihood of an examinee being familiar with the set-up of the TOMM (Tombaugh, 1996).

1.5 The Present Study

The present study set out to examine the new test in a sample of college students. The first aim of this study was to assess the difficulty of the individual items and organize them accordingly. The second aim of the study was to assess whether the use of two as opposed to one distractor might be a too difficult task and thus impact the ability to assess for response bias rather than memory.

Several hypothesis were made regarding the new test. First, it is was hypothesized that accuracy and latency on the PNT would positively correlate with accuracy and latency on the BNT. Second, PNT performance was predicted to be uncorrelated with education level, but education level would correlate with the BNT performance. Third, it was hypothesized that age would negatively correlate with performance on the PNT and

BNT. Finally, performance on the new measure of malingering was predicted to correlate with performance on the Reliable Digit Span.

CHAPTER II

METHOD

2.1 Participants

Participants were recruited from Cleveland State University's online research participation system (SONA) and from local activities groups using flyers. A total of 51 individuals participated in this study (34 females, 17 males). All participants were 18 years of age or older (*M*=31.71, *SD*=20.85) and English was their first language. The majority of the sample (82.4%) identified their ethnicity as "Caucasian." The average education level for the sample was 14 years (*SD*=2.22).

2.2 Materials

The PNT was administered to all 51 participants along with the BNT. All participants also filled out a demographic survey. A malingering test based on the TOMM (Tombaugh, 1996) was administered along with the Reliable Digit Span.

2.2.1 Demographic survey. The demographic survey included questions about gender, ethnicity, level of education, and native language.

2.2.2 The Boston Naming Test. The Boston Naming Test Second Edition, empirical short form (Williams et al., 1989) was administered in its entirety. The participant was instructed that they would be shown a picture and asked to name what it is. Each item has a 20 second time limit. The published directions of the BNT were followed, with the exception of discontinuation rules. Participants were able to correct their response within the allotted time, and were asked to clarify their final response if multiple were given. Semantic and phonemic cues were given when appropriate according to the BNT administration manual.

2.2.3 The Poreh Naming Test. The PNT is computer based confrontational naming task. Examinees view a color picture on a computer screen and name the object that is presented. The administrator records responses, response times, and any errors. If the participant was struggling, semantic and phonemic cues were administered, when appropriate.

If the participant did not appear know what the item is, the semantic cue was administered. If the participant appeared to be familiar with the item, but could not produce the correct name, the phonemic cue was administered. If the examiner was not sure which is appropriate, the semantic cue was administered first. If a participant did not produce a response after cues, it is noted in the response sheet. Participants that gave multiple responses to an item were asked to clarify their final response if necessary.

Poreh (2009) originally formulated the test items and software. Preliminary norms were collected by Martincin (2010) and Biesan (2012). The test was refined to 30 items in both instances. For the present study, items will be assessed based on difficulty in terms of accuracy and latency. Items consist of frequently used words and vary in difficulty. Based on data collection and analysis, items were eliminated if they appeared ambiguous or are biased by gender, age, or educational level. Items were arranged, for future use, according to difficulty.

2.2.4 Malingering measure. A series of PowerPoint slideshows were presented to all participants, and responses were recorded by the examiner. Each slide of the presentation for trials one and two had three, side-by-side pictures. Participants were be presented with a total of 40 slides with one target picture that was presented to them during the PNT, while the other two pictures presented were distractors.

The first trial immediately followed the completion of the PNT. Participants were instructed to tell the administrator which image had been presented to them while taking the PNT. After the first trial was given, a timed PowerPoint slideshow was given. For this portion, participants were instructed to simply watch the slideshow without naming the items. This slideshow presented each target item for a period of three seconds. The second trial was subsequently administered with target items and distractors presented in a different order from the first trial. The scoring sheet provides space for the administrator to record which image out of the three presented in the PowerPoint that the participant recognizes from the PNT. This measure was given immediately following administration of the PNT for each participant.

2.2.5 Reliable Digit Span. Participants were asked to read a string of numbers and asked to repeat the numbers back, in the same order with increasing difficulty. Then, participants were read a string of numbers and asked to repeat the numbers in reverse order, again with increasing difficulty (Wechsler, 2008). All responses were manually recorded by the test administrator.

2.3 Procedure

Participants received an introduction to myself and the study, before being asked to participate. Participants were informed that the procedures will take approximately 20-45 minutes. A private setting, with minimal distractions and a clear surface were utilized for testing. Informed consent was acquired from all participants prior to anything else. A copy of the consent form was given to each participant.

Following the consenting process, all participants were asked to fill out the demographic survey. Individuals were excluded from the study if English was not their first language. Next, the Reliable Digit Span, BNT, PNT, and malingering measure were administered. The order of the tests was varied to account for order effects, however the malingering measure was always given immediately following the PNT. Participants were debriefed, thanked for their participation, and asked for final questions before departure. Contact information was provided so that participants could ask follow-up questions if desired.

CHAPTER III

RESULTS

The mean for accuracy on the BNT was 24.22 out of 30 items (*SD*=4.37). For PNT accuracy, the mean was 37.06 out of 40 items (*SD*=2.18). Mean accuracy and latency for each item of the PNT and BNT are shown in Figures 1, 2, 3, and 4. The mean total score on the Reliable Digit span was 17.90 out of 32 points possible (*SD*=4.03). All participants obtained a perfect total score on the malingering measure (*M*=80.00, *SD*=0.00).

Internal reliability for the PNT and the BNT was evaluated with Cronbach's alpha. The PNT internal consistency was relatively poor (α=.58), which is poor. In contrast, the BNT achieved a much higher internal consistency (α=.83). This suggests that responses on the BNT were more consistent than the PNT for this sample. Items recommended for removal or improvement, based on unreliability identified by this study, are numbers 12 (trumpet), 21 (grasshopper), 22 (crab), 25 (vampire), and 27 (gorilla). After removing these items the PNT internal consistency improved (α=.66).

Pearson correlation of performance on the PNT and BNT reached statistical significance, r_{49}=.81, p<.001. Latency on the PNT and BNT was also significantly correlated, r_{49}=.70, p<.001. As one would expect, latency was negatively correlated with corresponding performance on the PNT (r_{49}=-.78, p<.001) and BNT (r_{49}=-.71, p<.001). Education positively correlated with BNT performance and, contrary to hypothesis, PNT performance. Performance on both naming tests also positively correlated with age. The correlations between naming test performance, age, and education can be found in Table 1 below. Analyses on the relationship between the Reliable Digit Span and malingering measure were unable to be conducted due to the complete lack of variance exhibited on the malingering measure.

Table 1
Correlations of Total Scores with Age and Education

		BNT Total	PNT Total	Age	Education
BNT Total	Pearson Correlation	1	.81**	.54**	.56**
PNT Total	Pearson Correlation	.81**	1	.54**	.55**
Age	Pearson Correlation	.54**	.54**	1	.77**
Education	Pearson Correlation	.56**	.55**	.77**	1

Note. **Significant at .01 level.

Stepwise linear regression was performed to examine the influence of education, ethnicity, gender, and age on PNT performance. Results showed that education and ethnicity significantly predict PNT performance. Education alone is a strong predictor of performance on the PNT, however ethnicity explains a significant additional amount of the variance in PNT performance. The regression coefficients indicate that being white, and having higher education predict better performance on the PNT. Results of the regression analysis, and the unstandardized regression coefficients are displayed below in Table 2 and Table 3.

Table 2
Stepwise Regression Model for PNT

Predictors	R	R^2	R^2 Change	F Change	Sig. F Change
Education	0.55	0.30	0.30	20.95	0.00
Education, Ethnicity	0.63	0.39	0.09	7.44	0.01

Table 3
Stepwise Regression Coefficients for PNT

Model	B	t	sig
Constant	29.56	17.84	0.00
Education	0.54	4.58	0.00
Constant	31.05	18.81	0.00
Education	0.45	3.96	0.00
Ethnicity	-1.80	-2.73	0.01

The same procedure was followed to examine the influence of education, ethnicity, gender, and age on BNT performance. Again, results showed that education and ethnicity significantly predicted naming test performance. For the BNT, ethnicity alone is a strong predictor of performance, but education explains a significant additional amount of the variance in performance. Together, education and ethnicity account for over half of the variance in BNT performance, while these two variables account for less than half of the variance in PNT performance. Again, the regression coefficients indicate that being white, and having higher education predict better performance on the BNT. Results of the regression analysis, and the unstandardized regression coefficients are displayed below in Table 4 and Table 5.

Table 4
Stepwise Regression Model for BNT

Predictors	R	R^2	R^2 Change	F Change	Sig. F Change
Ethnicity	0.57	0.33	0.33	23.65	0.00
Ethnicity, Education	0.71	0.51	0.18	17.40	0.00

Table 5
Stepwise Regression Coefficients for BNT

Model	B	t	sig
Constant	25.36	45.38	0.00
Ethnicity	-6.47	-4.86	0.00
Constant	13.04	4.36	0.00
Ethnicity	-5.13	-4.29	0.00
Education	.86	4.17	0.00

Figure 1 shows the mean accuracy for each PNT item prior to rearrangement, while Figure 2 shows the mean latency for each item prior to rearrangement. Figures 3 and 4 display the mean accuracy and latency for each BNT item for comparison. Figures 1-4 are located in *Appendix C* due to size. Based on these figures, it was clear that the Poreh Naming Test needed to be rearranged based on difficulty. One can also see that the BNT is not arranged based on difficulty, according to the data collected for this study.

Items for the Poreh Naming Test were evaluated based on difficulty. Easy items were identified to have fast mean reaction times and high mean accuracy among the sample. Moderate items have slower reaction times and lower accuracy. Hard items have the slowest reaction times and least amount of accuracy. Easy items were arranged to be at the beginning of the revised Poreh Naming Test, moderate items in the middle, and hard items were placed toward the end. The revised order is located in *Appendix D.* Figures demonstrating mean accuracy and latency based on the new order are located in *Appendix E.*

CHAPTER IV

DISCUSSION

The present study confirms the utility of the new test for the combined measures for the assessment of confrontational naming and response bias. The first hypothesis that was examined, that performance and latency on both naming measures would correlate was supported. This relationship between the two tests indicates that the PNT has construct validity. This is evidence that the Poreh Naming Test measures the same construct that the Boston Naming Test measures.

The remaining hypotheses of this study, however, were largely unsupported by the data collected. Reliability of the PNT was inferior to the BNT, possibly due to the PNT's lack of range with a totally normal population. Results did show that both the PNT and the BNT have a relationship with a number of confounding demographic variables. This further supports the notion that an improved measure of confrontation naming is required. Work should be done to reduce the biases of current naming tests. This can be accomplished by careful selection and continued analysis of test items.

The results of this study can inform construction and data collection of a revised Poreh Naming Test. First, the order of items should be administered in the rearranged by order of difficulty, as identified by this study. Second, separate normative data for ethnicity and education should be considered as a possibility for the PNT, based on the results of the stepwise regression. Third, to improve reliability a few problem items were identified by the current study and should be considered for removal. It is suspected that items 12 (trumpet), and 27 (gorilla) were unreliable due to the ambiguity of the images. Alternative answers should be considered for items 21 (grasshopper) and 25 (vampire). Item 21 was often named cricket, while item 25 was often named Dracula. Finally, items should be logically evaluated and potentially biased items should be removed.

The results of the study also indicate that the measure of effort requires additional attention. Although analyses were unable to be performed due to a lack of variance on the malingering measure, this is still informative. Every participant achieved a perfect score. Therefore, adding an additional distractor item to a visual measure of effort, does not impact difficulty.

4.1 Limitations

There are a number of limitations to this study. First, the participants of this study were mostly female, Caucasian, college students. This, along with the relatively small sample size, limits the population that the results can be applied to. Second, a clinical sample should have been collected to evaluate sensitivity and specificity of the PNT. Third, the participants were assumed to be drawn from the normal population and were not screened for health problems. Potential sampling of any unhealthy individuals could have influenced the results.

4.2 Future Research

Future studies should account for the limitations of this study by collecting a larger, more representative sample and screen for relevant health conditions. Further collection of data for the Poreh Naming Test should involve clinical populations in order to inform ongoing development of this novel measure. Recommendations made for removal and improvement of items should be considered in order to improve reliability of the PNT. Also, collecting and comparing performance on the PNT to vocabulary level may be informative and therefore beneficial to future development of the PNT; it should be confirmed that the PNT is not influenced by vocabulary level. Test-retest reliability of the PNT should be established by further research as well.

Studies entailing further development of the malingering measure should include a malingering manipulation and avoid the restricted response range exhibited by the present study. Additionally, research should compare the malingering measure to the TOMM. The Reliable Digit Span may not have been the most optimal comparative measure because it is a recall, rather than recognition, task. This measure should also be administered to a clinical sample to ensure that the task is not too difficult.

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APPENDIX A

Poreh Naming Test Items for this Study

Item No.	Item Name	Item No.	Item Name
1	Umbrella	21	Grasshopper
2	Swing	22	Crab
3	Glove	23	Microscope
4	Belt	24	Hourglass
5	Moustache	25	Vampire
6	Frog	26	Pallet
7	Kite	27	Gorilla
8	Accordion	28	Avocado
9	Strawberry	29	Soap
10	Zebra	30	Rhino
11	Anchor	31	Pelican
12	Trumpet	32	Piano
13	Cactus	33	Scroll
14	Helicopter	34	Compass
15	Tweezers	35	Toaster
16	Windmill	36	Volcano
17	Globe	37	Igloo
18	Iron	38	Truck
19	Broccoli	39	Violin
20	Taj Mahal	40	Pliers

APPENDIX B

Demographic Survey

Demographic Survey

1. Please circle your gender. Male Female

2. What is your first language? ___________________________

3. What is your age in years? ____ years

4. How many years have you attended school? ____ years

5. Please circle your ethnic identity. If you circle "other," please indicate your ethnic identity.

African American Asian Caucasian Hispanic

Indian Native American Middle Eastern

Other: ______________________

APPENDIX C

Initial Figures

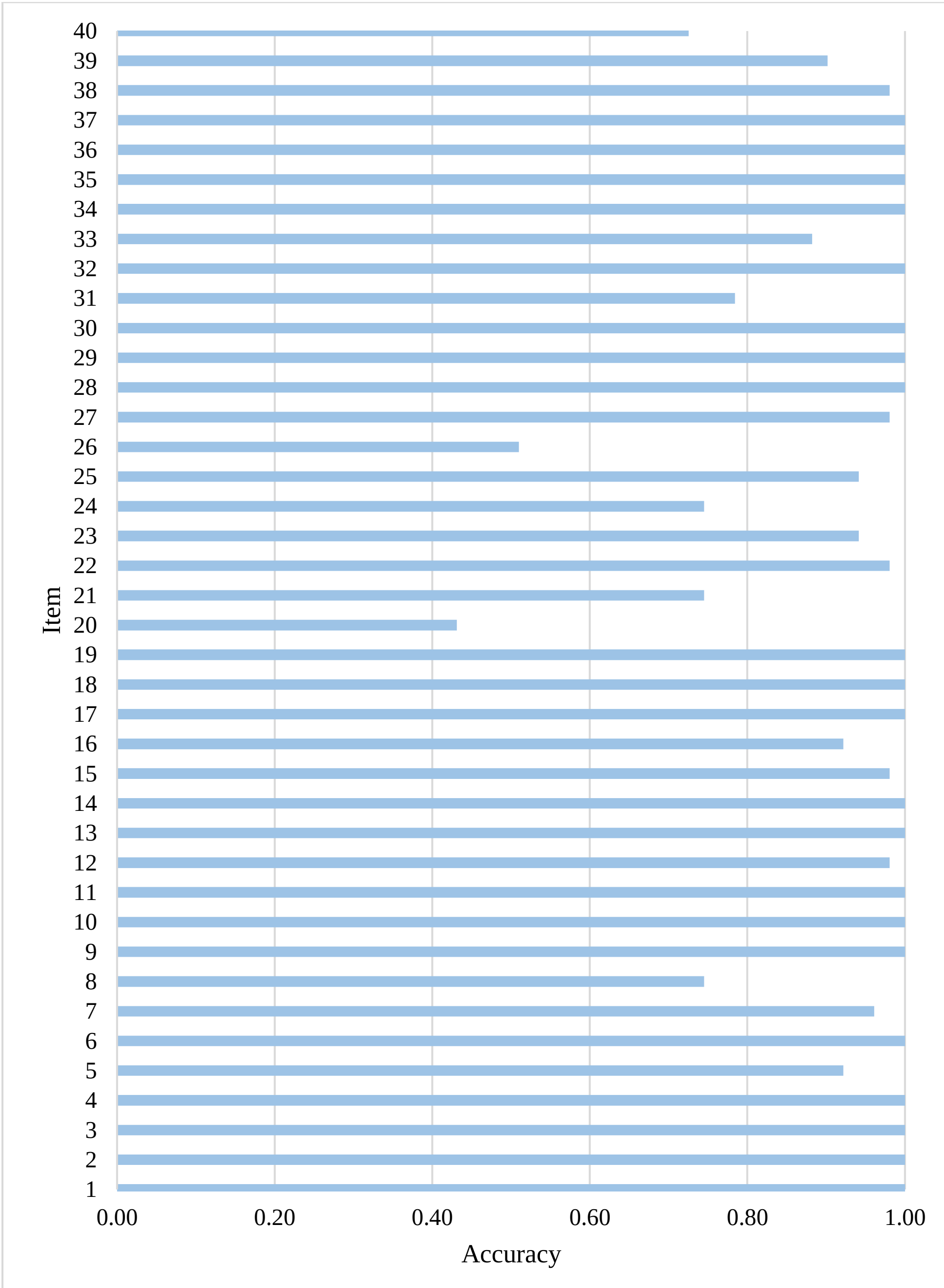

Figure 1. *Mean PNT Accuracy by Item.*

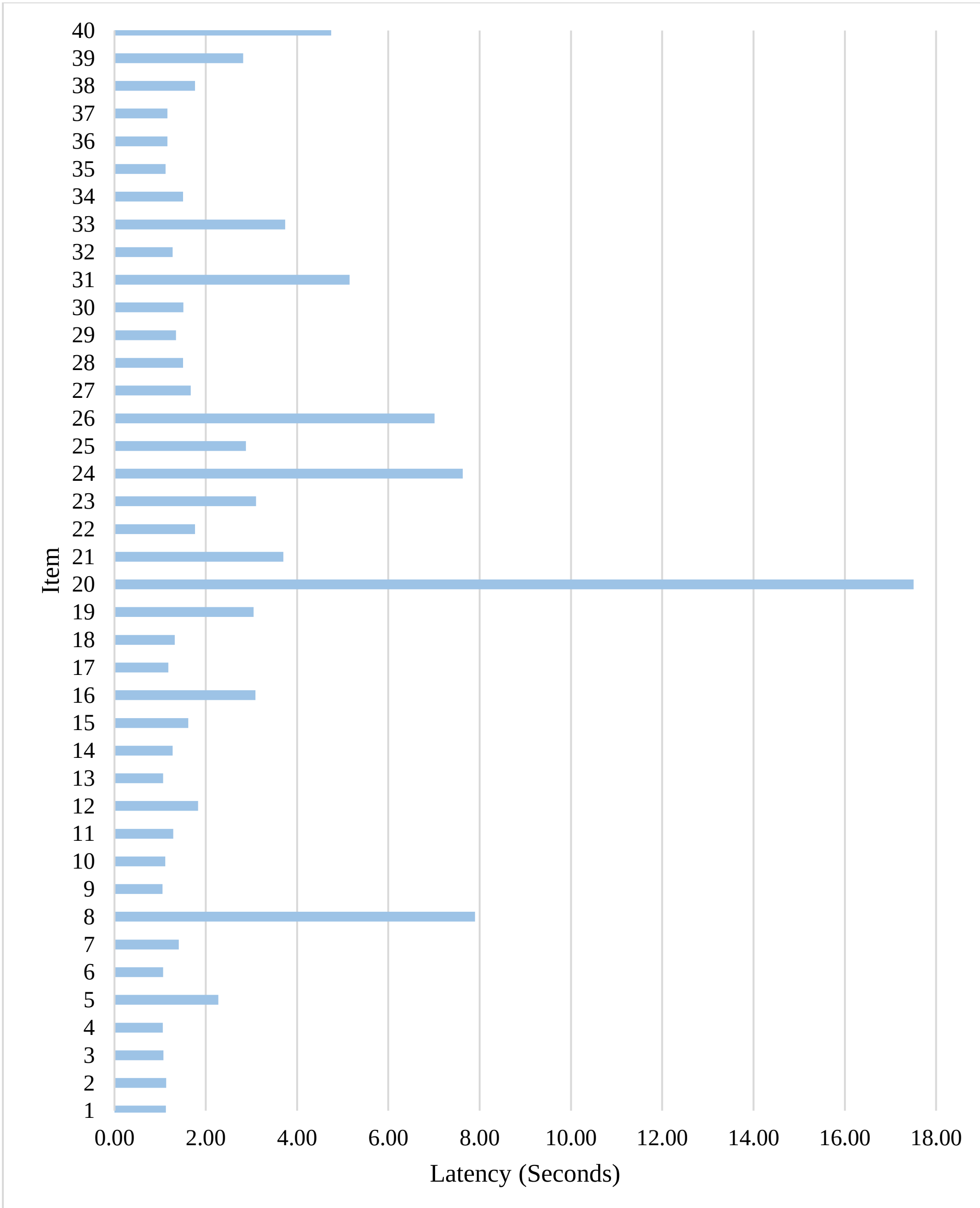

Figure 2. *Mean PNT Latency by Item*.

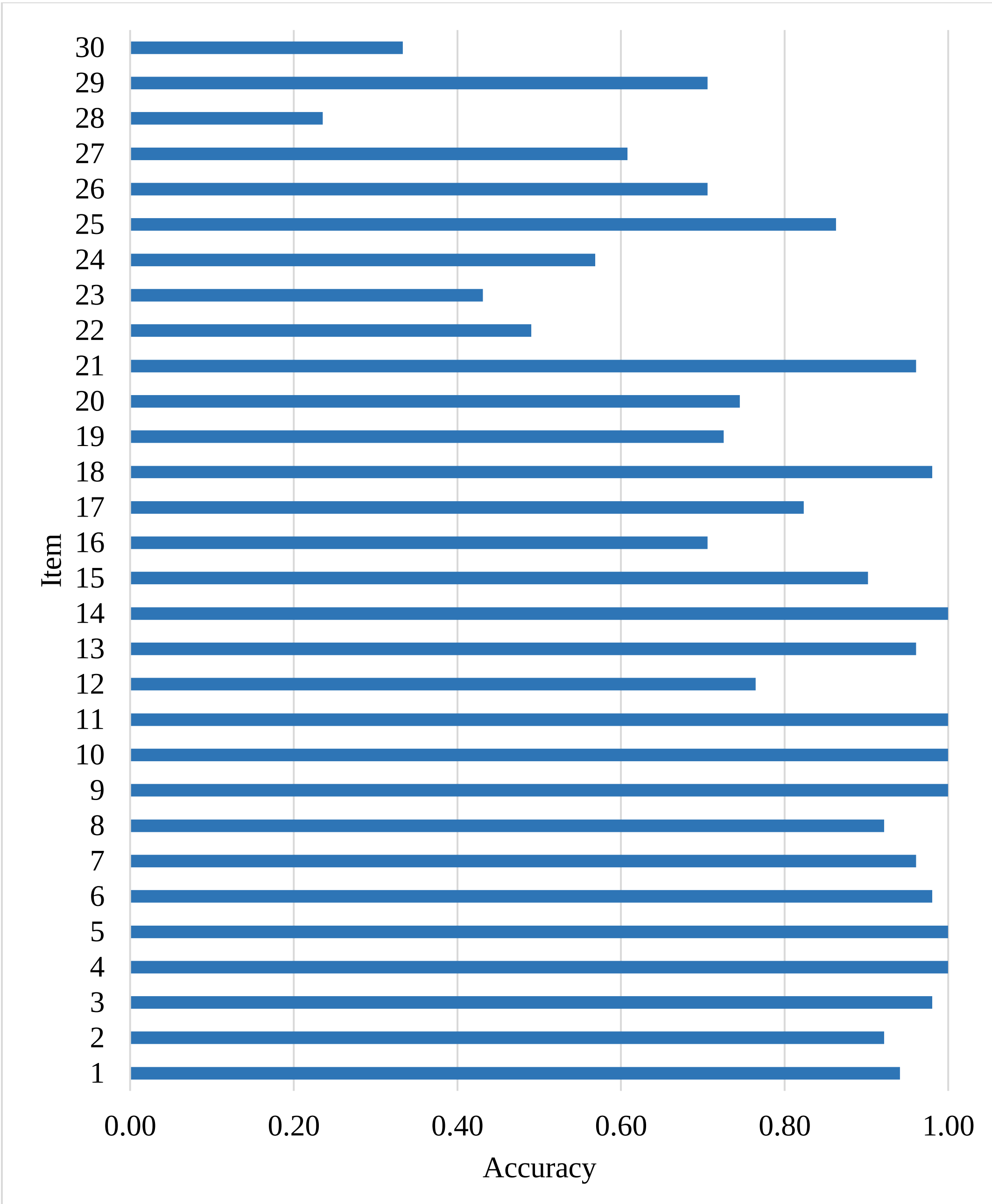

Figure 3. *Mean BNT Accuracy by Item.*

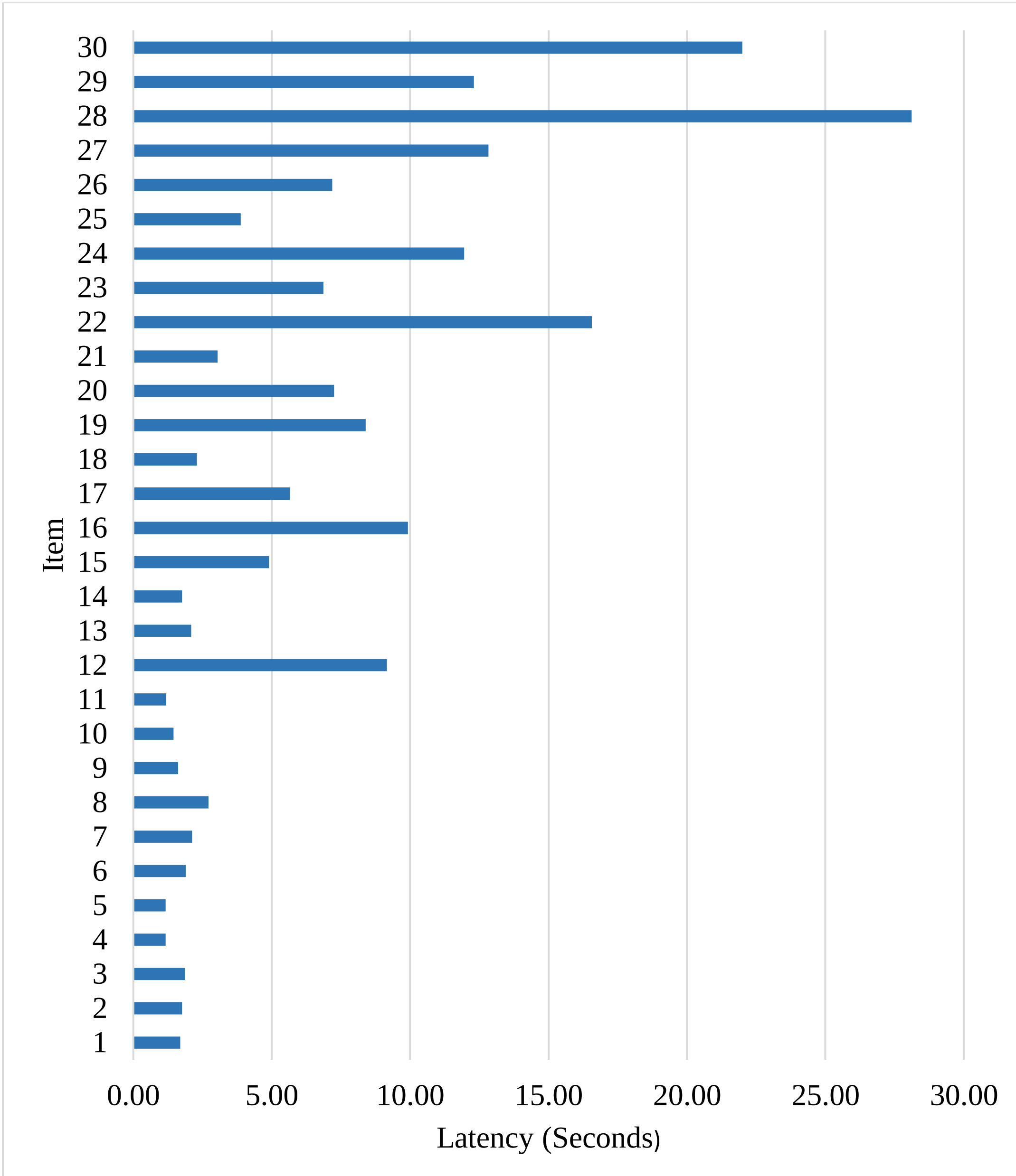

Figure 4. *Mean BNT Latency by Item.*

APPENDIX D

Recommended Revised Order for the PNT

New Item No.	Previous Item No.	Item Name	New Item No.	Previous Item No.	Item Name
1	1	Umbrella	21	19	Broccoli
2	2	Swing	22	12	Trumpet
3	3	Glove	23	15	Tweezers
4	4	Belt	24	22	Crab
5	6	Frog	25	27	Gorilla
6	9	Strawberry	26	38	Truck
7	10	Zebra	27	7	Kite
8	11	Anchor	28	23	Microscope
9	13	Cactus	29	25	Vampire
10	14	Helicopter	30	5	Mustache
11	17	Globe	31	16	Windmill
12	18	Iron	32	39	Violin
13	37	Igloo	33	33	Scroll
14	28	Avocado	34	31	Pelican
15	29	Soap	35	21	Grasshopper
16	30	Rhino	36	8	Accordion
17	32	Piano	37	24	Hourglass
18	34	Compass	38	40	Pliers
19	35	Toaster	39	26	Pallet
20	36	Volcano	40	20	Taj Mahal

APPENDIX E

Figures for Revised Order of the PNT

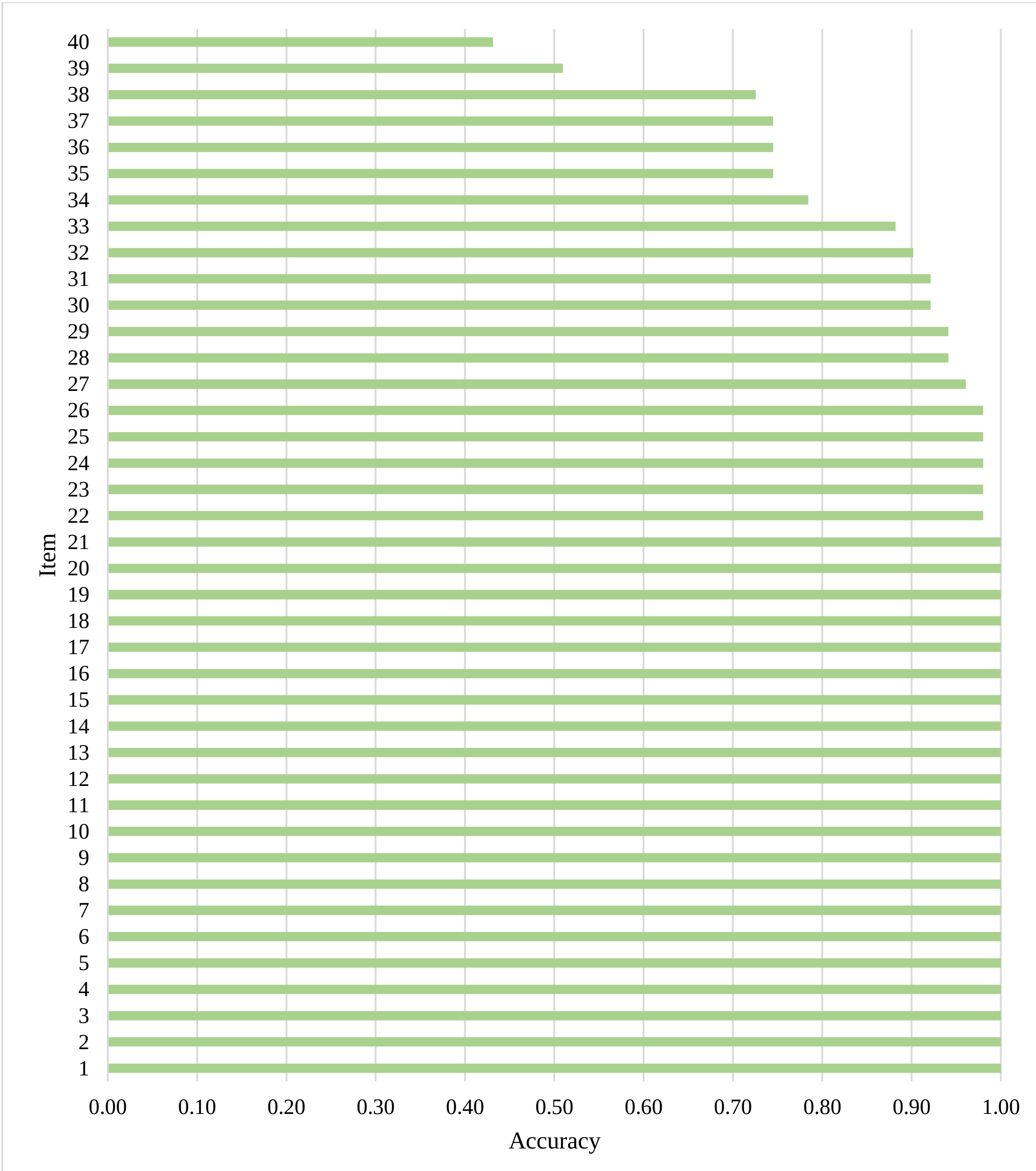

Figure 5. *Mean Revised PNT Accuracy by Item.*

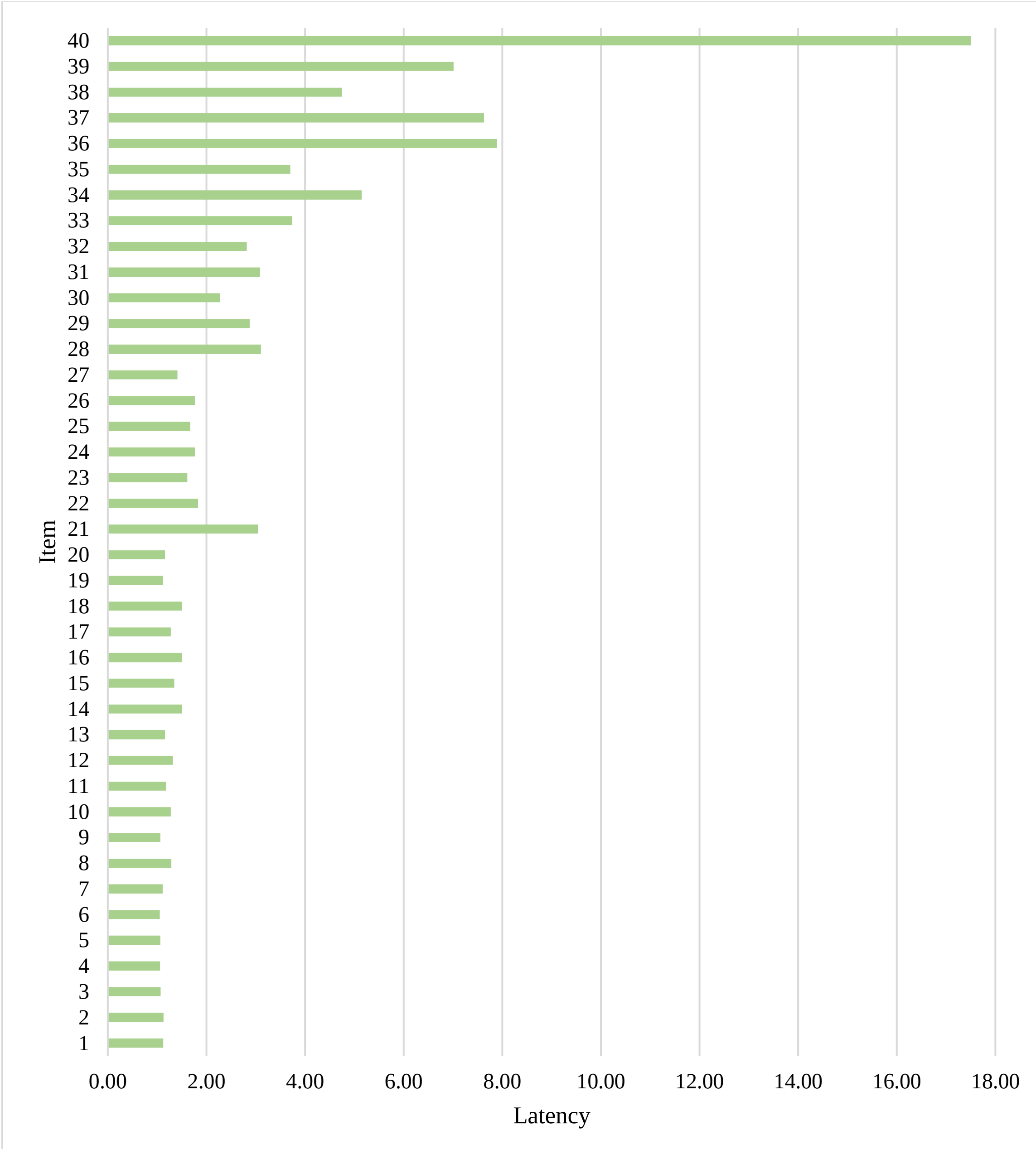

Figure 6. *Mean Revised PNT Latency by Item*.