Development of a Simple Thai Picture Word Recognition Test

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Abstract

Visual object recognition, and associating the object to names within a lexicon, is a core human cognitive skill. Furthermore, measurement of this ability has numerous clinical and educational applications. However, few tests exist in the Thai language. We describe preliminary development of a novel task for use with Thai Speakers, which involves associating photographs of objects with their common names. The participants are asked to decide whether a word matches, or does not match, a photograph shown of a relatively common object. The photos were all taken from a psycholinguistic image bank that has been normed on Thai speakers. There were 9 'match' trials and 9 'no match trials. The task was completed by a sample of 133 Thai adults, in face-to-face cognitive assessments. From the full set of 18 items, we found that a scale composed of subset of 7 'no match' items has reasonable internal consistency and test-retest reliability. In addition, some validation is provided by the observation that scores correlate with an existing test of visual confrontation naming, one already validated in Thailand. Though preliminary, our findings suggest that this test has potential, and could be further developed for use in clinical or education cognitive assessments in Thailand.

Keywords Mental lexicon, visual cognition, vocabulary, Thai language, semantic knowledge, neuropsychological assessment

Introduction

Semantic-lexical processing, such as 'vocabulary', is a distinctly human ability, and core to many other cognitive processes, including working memory and language comprehension (Cerone et al., 2022). In addition, the measurement of lexical knowledge, has multiple applied applications within psychology. For example, lexical knowledge is one of the best predictors of academic achievement at university level (Pluck, 2013) and has many social and forensic implications for school failure and delinquency (Isen, 2010). There are also many clinical applications involving the identification of cognitive impairment. However, the majority of the existing standardized assessment tools have been developed in a small number of developed countries (Pluck, 2003), leading to what Henrich et al., (2010) called a WEIRD bias (i.e., from Western, Educated, Industrialized, Rich, and Democratic cultures). In fact, despite

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the widespread use of standardized picture and word recognition tests in non-WEIRD cultures, it is usually challenging to adapt them for use with Thai people due to linguistic and cultural differences.

As an example, the Pyramids and Palm Trees Test (Howard & Patterson, 1992) is widely used in cognitive assessments to measure semantic memory. However, it was developed in a WEIRD country (the UK), and contains images that may not be recognizable in many cultures, such as a picture of a lord mayor <นายกเทศมนตรี> in traditional British ceremonial regalia. An attempt to develop the test for use in Thailand resulted in half of the images being changed to be appropriate to Thai culture (Singwicha et al., 2024). Without such amendments, cognitive tests provide an inaccurate and unfair evaluation of cognition.

Relying on tests developed in other countries could be problematic if the test materials are not culturally appropriate. One approach that has been successful in Thailand is the adaptation of picture description tasks. These are often used in WEIRD cultures to elicit spontaneous speech of patients. The most famous of this type is the Boston Cookie Theft picture, part of the Boston Diagnostic Aphasia Battery (Goodglass & Kaplan, 1983). As the name suggests, it shows American-looking children stealing cookies. One attempt to develop this for Thai culture changed the image to a scene of a farmer using oxen to plow a rice paddy (Gandour, 1982). Recently, images more relevant to urban life in Thailand, named 'Thais-at-Home' and 'Thai Temple Fair' have been used with automatic speech segmentation and machine learning, successfully distinguishing healthy individuals from those with cognitive disorders (Sangchocanonta et al., 2021). Another part of the Boston Diagnostic Aphasia Examination has also been adapted for use with Thai patients, the Boston Naming Test (Aniwattanapong, et al., 2019). It involves confrontation naming- the patient is shown drawings of objects and asked to name them. Nevertheless, the Thai version still uses the images used in the original test developed in the USA. Many of which are of questionable relevance in the Thai context (e.g., a canoe, a noose, a harmonica).

Recently, there has been a trend in test development to go beyond adapting materials from WEIRD countries. This is because that approach even, with careful test adaptation, still brings in the basic assumptions of the people who designed the test. As an example, ethnographic work with native American populations in Mexico led researchers there to conclude that WEIRD-designed executive function tests were not appropriate for the culture, simply because of what they required the participants to do. Therefore, it may be necessary to form novel tests that are consistent with cultural expectations (Gaskins & Alcalá, 2023). Although this seems to neglect the

knowledge-base from existing research, it has in fact long-been standard practice in cognitive neuropsychology.

Some progress has made in this direction for testing of language skill of Thai people with the development of detailed word lists that are balanced for phonemes, familiarity, and reliability (Tantibundhit, 2018). In addition, there is a bank of photos of objects, each with accompanying data on age of acquisition, imageability, familiarity, visual complexity, etc. rated by Thai adults (Clarke & Ludington, 2018). These are not tools that can be used directly for patient or research assessments, but they do provide materials that could be used to develop new tests.

In this paper we describe our preliminary attempts to develop a new test, for use in Thailand, with materials previously provided and standardized. The aim is to set the groundwork for a simple, bespoke test measuring visual recognition of objects and words.

Method

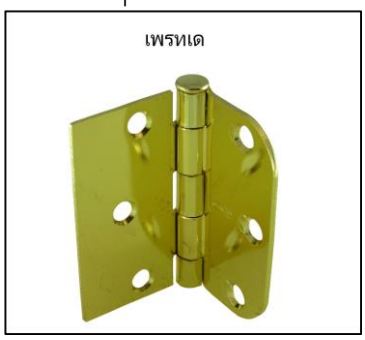
Development of the Thai Picture Word Test

Images for the test were selected from the Bank of Standardized Stimuli (BOSS), which is a publicly-available set of color photographs of 480 common objects. Each has been assessed for properties important in psycholinguistic research, such as familiarity, naming frequency, visual complexity, age of acquisition etc. (Brodeur et al., 2010). Although their properties were originally described for English speakers, Clarke and Ludington (2018) collected and published similar standardization details from a sample of 584 Thai speakers in Bangkok. From that set of 480 images, we identified the images in which at least 10% of the Thai adults assessed by Clarke and Ludington failed in confrontation naming. Images of 193 different objects that met that criterion. However, most were given multiple different names by the Thai test sample who could name them. We selected 18 different images from the few that were consistently named with the same Thai word by at least 50% of Thai speakers who were able to name them (i.e., with H scores ≤1), meaning there was a common modal name for each object used by most Thai speakers. So, even though the images were relatively difficult for some Thai people, people who correctly named the objects, consistently produced the same name.

For our Thai Picture Word Test, we used one of those 18 images in each trial. We randomly allocated 9 images to be used in ‘match’ trials. For those trials, each was paired with the modal word (i.e., the correct word describing the object in Thai). As an example, an image of a spatula was paired with the Thai word <ตะหลิว>. The other 9 images were used in ‘no match’ trials. Each was paired with a pseudoword. These were words of similar length to the actual Thai words used,

and appeared as if, but were not, real Thai words. Examples are given in Figure 1. The task for the participant is to look at each picture-word pair and answer whether the word shown is a word that is used to describe the object shown, yes or no.

Figure 1: Examples of the stimuli used, showing a 'no match' trial and a 'match' trial.



One point was awarded for each correct response given, such that the maximum possible score, indicating perfect performance, was 18 points. Details of the 18 trials used in the Thai Picture-Word Test are shown in Table 1. Test materials can be downloaded, free of charge, from: https://gpluck.co.uk/. In the next phase we assessed the ability of this task by including it with a battery of cognitive tests in a larger study of cognitive abilities.

Table 1

Details of the stimuli used in the full Thai Picture Word Test, and the reduced 7-item version

Trial	Picture	Word / pseudoword	Trial Type	% Accuracy	BOSS Filename[1]
1	Baseball	ลูกเบสบอล	Match	99	baseball01a.jpg
2	**Sponge**	**เปรียน**	**No-match**	**93**	**sponge01.jpg**
3	Chain	โซ่	Match	100	chain.jpg
4	Cherries	เชอรี่	Match	99	cherries.jpg
5	Cutting Board	เขียง	Match	96	cuttingboard.jpg
6	**Clamp**	**ปราฟ**	**No-match**	**88**	**cclamp.jpg**
7	Tambourine	เดียนเทน	No-match	**86**	tambourine.jpg
8	Lime	มะนาว	Match	94	lime.jpg
9	Asparagus	โร	No-match	**98**	asparagus.jpg
10	Red Pepper	พริกหยวก	Match	95	pepper04a.jpg
11	**Hinge**	**เพรทเด**	**No-match**	**89**	**hinge.jpg**
12	**Pliers**	**โมด**	**No-match**	**93**	**pliers02b.jpg**
13	Spatula	ตะหลิว	Match	100	spatula03.jpg
14	**Statue**	**กราป**	**No-match**	**96**	**statue01.jpg**
15	**Drill**	**เพลี่ยน**	**No-match**	**92**	**drill01b.jpg**
16	Bow	โบว์	Match	100	giftbow04.jpg
17	Key Chain	พวงกุญแจ	Match	100	keychain.jpg
18	**Pizza**	**เทียง**	**No-match**	**99**	**pizza.jpg**

[1] Brodeur et al., (2010). Items in bold were selected for inclusion in the final 7-item version.

Participants

A large sample of adults was assessed, comprising 133 Thai-fluent participants. All participants were recruited via appeals on social media etc., or via personal contacts of the researchers. Participants were included if they had no visual

impairments, no history of neurological or psychiatric conditions that interfere with the performance, and were able to read Thai. There were 47 women (35%) and 83 men (62%), the remainder (3%) identifying as other gender or preferring not to say. The mean age in years was 33.5 (*SD* = 15.3, range 18-68). The sample likely overrepresents more highly-educated people, as the mean years of education was 17.2 (*SD* = 3.2). The sample included 41 undergraduate students (31%), however, most were working, unemployed, retired etc.

Assessment tools

We included the Thai Picture Word Test, as described above. There are very few existing cognitive tools available to measure object-word knowledge, in a research context, among the Thai population. As a potential measure to validate the Thai Picture Word Test, we included the Short Boston Naming Test (Thai version). Black and white line drawings of objects are shown and the participant is asked to name them, accuracy and time to respond are recorded. It has been validated, within a Thai neuropsychological context, and been found to have good psychometric properties (Aniwattanapong et al., 2019).

Procedure

The data was collected as part of a larger study of cognitive abilities. Each participant was tested, one-to-one by a student research assistant, supervised by a doctoral level expert in cognitive assessment. The stimuli were presented in a PowerPoint file, and oral responses recorded by hand. Interviews were conducted in private locations. Each participant first provided written, informed consent to participate. Then basic demographic information was collected, followed by the cognitive assessments. Participants were debriefed and thanked for their participation, no compensation for participation was given.

Results

We first examined the internal consistency of the Thai Picture Word Test. To produce the most internally consistent set of items we examined the Kuder-Richardson-20 Coefficient (KR20). This is equivalent to the Cronbach's alpha values that are often used with continuous variables. The initial full set 18 items had a relatively poor KR20, at .47. However, we examined and iteratively deleted the individual items that improved the overall value. This resulted in reduced set of 7 items with an overall KR20 value of .61. This is below the threshold usually accepted for new scale development, but within the acceptable range (i.e., α/KR20 > .60) for exploratory research (Hair, Black, & Babin, 2019), such as reported here. It is also

equivalent to that reported in psychometric studies of other orally-based cognitive tests (e.g., MacPherson et al., 2014). Furthermore, a relatively low value would be expected, as Cronbach's α/KR20 is dependent on number of items within the scale, consequently, the observed value is above the advised threshold (.5), below which validity may be unduly affected (Schmitt, 1996).

Examination of the 7 items indicated that they were all words in which false positive errors were made, meaning that the correct response was to say 'no', the word does not match the object (i.e., in 'no match' trials). This clustering is somewhat expected, as 'matching' responses are considered to involve quite different cognitive processes to 'no match' responses (Stadthagen-Gonzalez et al., 2009), and a scale that included both types would therefore not likely to be internally consistent. This difference in 'match' and 'no match' trails is also revealed in the error rates. For the 'match' trials, the accuracy was 98.1% (*SD* = 4.2), compared to the lower figure of 92.3% (*SD* = 12.6) in the 'no match' trials.

That only 7 items are retained is actually not surprising when considered in the context that there were only 9 items that required a 'no match' response to be scored as correct. On that 7-item scale, the mean score in the full sample of 133 participants was 6.5 (*SD* = 1.0, range = 1-7), out of a possible maximum score of 7, or as a percentage-92.5% (*SD* = 14.3). Although this is clearly negatively skewed with a strong ceiling effect, we would hypothesize that people with lower educational experience would perform worse on this task, with less skewing of total scores. Recall that the current test sample of participants overrepresents the highly-educated. That was confirmed by analysis of the data. The 21 participants who made more than two errors on the task had a mean average of 15.4 (*SD* = 3.7) years of education, compared to a mean average of 17.6 (*SD* = 3.0) in the remainder who made fewer than 2 errors. In fact, for participants with less than 15 years of formal education, scores on the 7-item Test had an approximately normal distribution, not differing from criteria for normal distribution based on skew and kurtosis (Kim, 2013).

We also examined the test-retest reliability on a subsample of 26 participants who were tested a second time, approximately five-weeks later (mean delay = 35 days, range 21 – 61 days). This retest was performed by the same research assistant on each occasion. The intraclass correlation (two-way mixed model) for the full 18-item scale was .70. Restricting the analysis to the 7 items that showed the best internal consistency revealed a somewhat lower value of .58. However, that would still be considered 'good' test-retest reliability by conventional standards for interpretation of intraclass correlation (Matheson, 2019).

To assess validity, we examined the correlations with scores on the Boston Naming Test. Due to skewing of the distributions, non-parametric Spearman's RHO

is used (two-tailed). Accuracy on the full (18-item) Thai Picture Word Test was positively correlated with accuracy (r = .19, p = .03), and negatively correlated with time to respond (r = -.21, p = .02), on the Boston Naming Test. The shorter (7-item) version was significantly and negatively correlated with time to respond (r = -.20, p = .02). The correlation directions all supported the convergent validity of the new task, and the magnitude of the correlation sizes would be considered medium-sized for psychological research (Gignac & Szodorai, 2016).

Discussion

There is a need for cognitive assessments that are standardized, straightforward, easily administered, and adaptable across different demographic backgrounds in Thailand's healthcare and educational systems. Here we provide provisional details about a possible brief assessment of language in Thai. The aim of the was to explore the possibilities of a basic picture and Thai word recognition test specifically for Thai speakers while being psychometrically sound and utilizing familiar images and common Thai terminology. The test measures Thai vocabulary, specifically the overlap between object recognition, semantics and lexical knowledge. We provide provisional evidence for the reliability and validity of the test. In addition, it was well-received by participants across different age and literacy levels.

Quantification of levels of language development, such as provided by this brief screening assessment, is not only essential for assessing communication competency and learning in educational settings, but also for clinical evaluations. Language skill, particularly vocabulary level, is the best overall predictor of higher cognitive functions, and is widely used to determine levels of cognitive impairment by providing a baseline measure of ability (Pluck & Ruales-Chieruzzi, 2021). Consequently, assessment of language and literacy are essential for screening neurological and psychopathological disorders for cognitive impairment or decline. Vocabulary is also an important factor in many societal and socioeconomic concerns. For example, juvenile delinquents often show reduced vocabulary, relative to their non-verbal cognitive abilities, likely indicating socioeconomic disparities, particularly school failure (Isen, 2010). This same phenomenon, when tested for, is observed in samples of adults experiencing homelessness (Pluck et al., 2020), indicating its relevance to challenging effects of socioeconomic deprivation.

On close examination of the proposed Thai Picture Word Test, several issues should be considered. Firstly, what exactly is being measured? Successful performance of the task involves linking lexical wordforms to visual objects. It can therefore be seen as involving lexical knowledge and object recognition. From a cognitive science perspective, the latter of these is often separated into precategorical

and associative object recognition (Riddoch & Humphreys, 1993). This distinction is borne out by the observation that there appears to be a general precategorical domain-general recognition factor (Chow et al., 2023), while the concept of a separate associative form of recognition (e.g., linking the object to a name), is revealed by the existence of various forms of associative agnosia in which basic precategorical recognition is intact (Behrmann & Nishimura, 2010). The current test although necessarily involving basic visual processes, likely tests mainly associative object recognition processes. Note that all of the items retained were items in which a 'no match' response would have been correct, so participants earned points for deciding that the word and picture did not match. Conversely, when participants made errors, the pseudowords were accepted as being possible Thai names for the objects. Therefore, the error made is relatively high level, perhaps at the level of object recognition.

A second issue is that although there is a high ceiling effect on the test (overall 92% correct in the current sample), this may not be a problem if used for screening clinical disorders, perhaps as part of a larger battery of tests. In such tests, it is commonplace for cognitive tests to have ceiling effects in non-clinical samples. In that way, impaired performance of clinical cases becomes easier to detect, as the normal range is narrowly clustered. As an example, non-impaired Thai adults score about 97% correct on the Thai Mini-mental State Examination, however, it is still very accurate at identifying clinical cases of cognitive impairment, who tend to score much lower (Dharmasaroja et al., 2020).

A third issue worth commenting on regards the photographs used. The photo bank employed in this study was originally developed with English speakers in Canada (Brodeur et al., 2010), which on the surface could be considered a problem for producing a bespoke, culturally-appropriate test for use in Thailand. However, the standardization of set was later repeated in a psycholinguistic study of a large sample of Thai participants (Clarke & Ludington, 2018). Furthermore, none of the photographs used in the final version of the test presented here would be culturally inappropriate, that is, they are photos of objects found widely in Thailand: a sponge, a clamp, a hinge, pliers, a statue, a drill, and a pizza. In fact, the two items of the type ('no-match') that were excluded were a tambourine and asparagus, which are the two items which are not common in Thai culture.

As for the psychometric qualities of the proposed test, they could be considered to be adequate. The test-retest reliability of the 7-item subset was less than the full 18-item scale. Nonetheless, both of the forms achieved the criterion for high reliability (Matheson, 2019). Convergent validity was demonstrated by medium-sized correlations with the Boston Naming Test. Particularly, slower naming times were

associated with worse scores on our Thai Picture Word test. The findings provide provisional support that the tool measures the intended cognitive ability, but also show its potential in resource- or time-limited settings, such as educational institutions, community health programs, and rural clinics. Furthermore, its ease of use makes it possible for qualified non-specialists to administer it, increasing access to cognitive and language screening, especially in underprivileged communities. This contrasts sharply with some other tests developed for measuring language skill of Thai people that are technically very complex (e.g., Sangchocanonta et al., 2021).

Several limitations should be noted. The researchers used convenience sampling, and some of the more educated participants found the material easy. Different dialects used in different parts of Thailand may also cause objects to be misidentified because of different terminology. Furthermore, additional research is required to monitor the cognitive changes over time while assessing the test's sensitivity and specificity in identifying any cognitive dysfunction, such as mild cognitive impairment, dementia, or language delay. This culturally-appropriate tool could also be integrated into an online format to increase the accessibility.

In conclusion, the development of the Thai Picture Word Test described in this paper is a small, but meaningful advancement in the creation of cognitive assessments that are suitable for Thai-speaking communities, both linguistically and culturally. It fills a gap caused by current assessments that are mostly developed in WEIRD countries. That has resulted in tools containing questions and stimuli that adopt the conventions or linguistic structures of the cultures of origin. For that reason, rather than adapt an existing test from a WEIRD culture, we combined culturally relevant content with a bespoke, easy-to-understand administration approach. Due to its simple, reliable, and user-friendly design, it has potential, with further development, to be well-suited for use in resource-constrained settings, where access to trained staff or comprehensive testing tools may be limited. Beyond its immediate use, this instrument promotes broader efforts in inclusive assessment by acknowledging the importance of cultural context, language diversity, and educational equity.

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