Development of a Thai phonetically balanced monosyllabic word recognition test: Derivation of phoneme distribution, word list construction, and response evaluations

Charturong Tantibundhit [a,c,e,*], Chutamanee Onsuwan [b,c,e], Adirek Munthuli [a,c,e],
Ploypailin Sirimujalin [a,c,e], Thanaporn Anansiripinyo [b,c,e], Sutanya Phuechpanpaisal [a,c,e],
Nida Wright [d,e], Krit Kosawat [f]

[a] Department of Electrical and Computer Engineering, Faculty of Engineering,Thailand
[b] Department of English and Linguistics, Faculty of Liberal Arts, Thailand
[c] Center of Excellence in Intelligent Informatics, Speech and Language Technology, and Service Innovation (CILS), Thailand
[d] Department of Otolaryngology, Faculty of Medicine, Thailand
[e] Rangsit Campus, Thammasat University, Pathum Thani 12120, Thailand
[f] NECTEC, National Science and Technology Development Agency (NSTDA), Pathum Thani 12120, Thailand

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ABSTRACT

This paper proposes a test tool for Thai word recognition, the Thammasat University Phonetically Balanced Word List 2014 (TU PB'14), standardized on several major criteria: phonemic balance, familiarity, reliability, list equivalency, and homogeneity. Phoneme distributions from the largest written Thai corpus (InterBEST) were obtained and used to construct five phonetically balanced word lists, each containing 25 frequently occurring monosyllabic words. Listeners' percent correct discrimination scores from test and re-test sessions were not significantly different, confirming test reliability. Detailed analysis of listeners' errors revealed that perceptual errors occurred predominantly for initial sound only, final only, and initial together with final. In terms of list equivalency and homogeneity, derived psychometric function slopes of TU PB'14 ranged from 0.0941 to 0.1155, while intensities required for 50% intelligibility ranged from 41.0279 to 41.3697. Two-way Chi-Square analysis performed on both parameters indicated that there was no significant difference among the word lists.

1. Introduction

An audiological examination generally consists of pure-tone audiometry and speech audiometry. Speech audiometry includes a series of tests; one which detects a patient's speech reception threshold (SRT) and the other which determines word recognition score (WRS). One of the techniques extensively used to measure WRS is through phonetically balanced word lists (PB lists) (Tillman and Carhart, 1966). A single PB list is usually employed during a hearing examination session. Therefore, to prevent learning effect and memorization, several test lists, which are interchangeable should be available (Lidén and Fant, 1954). PB lists have been created for many languages and in addition to phonetic balance, various criteria have been taken into account, i.e., word frequency, word familiarity, syllable structure, lexical neighbours, and equal range of difficulty (Sagon, 2006).

Typically a 50-item PB word list is used, referred to as a full or whole list. Using 50 items decreases the variability in WRSs, while the test time

is still short enough for clinical applications (Lehiste and Peterson, 1959; Peterson and Lehiste, 1962; Tillman and Carhart, 1966; Wang and Su, 1979). However, some audiologists frequently use 25-item word lists, which are called half or partial lists to shorten test time and reduce subject's fatigue (Martin et al., 1994). In addition, half lists were usually constructed by arbitrarily dividing full lists into two parts (Mendel and Danhauer, 1997). Therefore, these half lists were not guaranteed for the features that were guaranteed for the full lists (Tsai et al., 2009).

In Thailand, there has been a set of nine word lists, the first set of five monosyllabic word lists (FTL) was developed by Department of Communication Sciences and Disorders, Faculty of Medicine Ramathibodi Hospital, Mahidol University, and was most widely used in Ear Nose Throat (ENT) clinics at public and/or private hospitals as shown in Table 1. Each word list is composed of 25 monosyllabic words. However, there is a large degree of asymmetrical phoneme occurrences among the lists (Munthuli et al., 2014a; 2014b). It is unlikely that the lists were evolved from a set of reliable phoneme distribution data (see shaded numbers in

Table 1
First Thai monosyllabic word lists (FTL).

No.	List 1	List 2	List 3	List 4	List 5
1	อ่าน [ʔàːn] (read)	รถ [rót] (car)	ซื้อ [súːɯ] (buy)	อ้วน [ʔûaːn] (fat)	ปาก [pàːk] (mouth)
2	เป็ด [pèt] (duck)	ตาย [tāːj] (dead)	เคาะ [kɔ́ʔ] (knock)	ยอด [jɔ̂ːt] (peak)	อุ้ม [ʔûm] (carry)
3	เต่า [tàw] (turtle)	จริง [tɕīŋ] (true)	ลาด [lâːt] (slope)	ตาม [tāːm] (follow)	ญาติ [jâːt] (relative)
4	ไกล [klāj] (far)	ถ้วย [tʰûaːj] (cup)	ฉาย [tɕʰăːj] (show)	ร้อน [rɔ́ːn] (hot)	เร็ว [rēw] (fast)
5	ผ้า [pʰâː] (fabric)	เสื้อ [sûaː] (shirt)	แว่น [wên] (glasses)	ปู่ [pùː] (grandfather)	ผม [pʰŏm] (hair)
6	ถุง [tʰŭŋ] (bag)	ว่าว [wâːw] (kite)	ขาด [kʰàːt] (torn)	คน [kʰōn] (human)	ฝ้าย [fâːj] (cotton)
7	เสื้อ [sûaː] (shirt)	พัด [pʰát] (fan)	บ่อ [bɔ̀ː] (pond)	แก้ม [kɛ̂m] (cheek)	วัด [wát] (temple)
8	บ้าน [bâːn] (home)	ทำ [tʰām] (do)	อิ่ม [ʔìm] (full)	ชั้น [tɕʰán] (layer)	ไม้ [máːj] (wood)
9	ม้า [máː] (horse)	ชัด [tɕʰát] (clear)	ต้น [tôn] (trunk)	ผัด [pʰàt] (fry)	หก [hòk] (six)
10	พาน [pʰāːn] (tray)	ซ่อม [sɔ̂m] (fix)	ดิน [dīn] (soil)	ดำ [dām] (black)	กล้วย [klûaːj] (banana)
11	ลิง [līŋ] (monkey)	แม่ [mê:] (mother)	จบ [tɕòp] (end)	แถว [tʰɛ̆ːw] (row)	ดื่ม [dɯ̀ːm] (drink)
12	ฉิ่ง [tɕʰìŋ] (small cymbal)	ผึ้ง [pʰɯ̂ŋ] (bee)	คือ [kʰɯ̄ː] (be)	ห้าม [hâːm] (prohibit)	ขุ่น [kʰùn] (opaque)
13	แหวน [wĕːn] (ring)	ขวด [kʰùaːt] (bottle)	ผ่าน [pʰàːn] (pass)	สาย [sǎːj] (late)	งอ [ŋɔ̄ː] (bend)
14	จาน [tɕāːn] (dish)	ปืน [pūːn] (gun)	สร้อย [sɔ̂j] (necklace)	จันทร์ [tɕān] (moon)	ช้าง [tɕʰáːŋ] (elephant)
15	ฝน [fŏn] (rain)	อุ่น [ʔùn] (warm)	ไทย [tʰāj] (Thai)	บุญ [būn] (merit)	โต๊ะ [tóʔ] (table)
16	หนู [nŭː] (mouse)	บัว [būaː] (lotus)	งาม [ŋâːm] (prong)	ฝูง [fŭːŋ] (group)	เป็ด [pèt] (duck)
17	ช้อน [tɕʰɔ́ːn] (spoon)	ฉาบ [tɕʰàːp] (cymbal)	ยิง [jīŋ] (shoot)	มาก [mâːk] (numerous)	เคย [kʰɤ̄ːj] (ever)
18	เรือ [rɯ̄aː] (boat)	ไฝ [făj] (mole)	ราก [râːk] (root)	น้อย [nɔ́ːj] (few)	ช้ำ [tɕʰám] (bruise)
19	ยุง [jūŋ] (mosquito)	ยาม [jāːm] (guard)	ชีพ [tɕʰîːp] (life)	พบ [pʰóp] (meet)	หลับ [làp] (sleep)
20	ควาย [kʰwāːj] (buffalo)	เงาะ [ŋɔ́ʔ] (rambutan)	ฟ้า [fáː] (sky)	ง่าย [ŋâːj] (easy)	นิด [nít] (little)
21	เด็ก [dèk] (child)	ดาว [dāːw] (star)	หอม [hɔ̌ːm] (aromatic)	ลุง [lūŋ] (uncle)	สิบ [sìp] (ten)
22	หอย [hɔ̌j] (clam)	ก้าว [kâːw] (step)	พระ [pʰráʔ] (monk)	ทอง [tʰɔ̄ːŋ] (gold)	แท้ [tʰɛ́ː] (genuine)
23	งู [ŋūː] (snake)	เล่น [lên] (play)	ฝิ่น [fìn] (opium)	ฉัน [tɕʰăn] (I, me)	พูด [pʰûːt] (speak)
24	ฟัน [fān] (tooth)	ห่าน [hàːn] (goose)	กรรม [kām] (karma)	ฟัง [fāŋ] (listen)	ฟอง [fɔ̄ːŋ] (bubble)
25	ธง [tʰōŋ] (flag)	ค่ำ [kʰâm] (night)	ปลา [plāː] (fish)	ว่าว [wâːw] (kite)	จอบ [tɕɔ̀ːp] (hoe)