The Thai Version of the German Aachen Aphasia Test (AAT) : Description of the Test and Performance in Normal Subjects

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Abstract

The Aachen Aphasia Test (AAT), originally developed as a test for aphasia language disorders in Germany, consists of six spontaneous speech rating scales and five subtests : Token Test, Repetition, Written Language, Confronting Naming and Comprehension. The study aimed to describe the linguistic properties of the AAT Thai version and to investigate the test performances of the normal subjects. In this study some problems of linguistic changes in the construction of the Thai version were discussed. The results revealed that the normal subjects' performances on the test were independent of age, sex and education level. Therefore, the Thai version of AAT is applicable to the differential diagnosis of the communicative ablities of Thai aphasic patients.

In Thailand, aphasiology is still in its early stages of development, both theoretically and clinically. The diagnostic assessment of aphasia has tended to follow the same approaches and to use the same methods as those of the western world. Since the Boston Diagnostic Aphasia Examination (BADE),[1] the part of auditory disturbance of the Minnesota Test for Differential Diagnosis of Aphasia (MTDDA)[2] and the Porch Index of Communicative Ability (PICA)[3] were modified. Aphasia is a language impairment, it is reasonable to expect that its characteristics may vary depending on the properties and strutures of the particular language spoken in a country. Therefore, a direct one-to-one translation of a Western aphasia test will capture neither the specific language properties nor the sociocultural peculiarities of the Thai language and the Thai culture. An indiscriminate acceptance of a Western aphasia test would thus constitute a major obstacle for an accurate diagnosis of aphasia in Thai speaking patients and bias an examination of the incidence of aphasia in Thailand.

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A few aphasia assessment procedures are currently in use in most of the Thai speech clinics, non of which is properly adapted to and standardized for the Thai language. Therefore, a German aphasia test, the Aachen Aphasia Test (AAT)[4] was adapted by the first author to the Thai language and to Thai sociocultural conditions in close collaboration with authors of the original AAT. The AAT was chosen because of its explicit linguiatic criteria for item construction and its demonstrated psychometric validity and reliability properties[5,6]. Adaptations of the AAT to the Italian and Dutch language have been published as well. The modified tests essentially possess the same psychometric properties, although there are substantial differences between the language involved[7].

The AAT is designed for a selection of aphasia from non-aphasic patients as well as a statistically oriented syndrome classification according to major (standard) aphasia syndromes (global aphasia, Wernicke's aphasia, Broca's aphasia, amnesic aphasia, conduction aphasia, transcortical aphasia)[8]. Aphasic language disorders are quantitatively expressed in a performance profile encompassing major primary (repetition, naming and auditory comprehension) and secondary (reading, writing and reading comprehension) language modalities. Due to its good reliability properites, the AAT is also suited for the evaluation of changes in test performances over time or subsequent to language therapy. A first step in examining the psychometric properties of an aphasic test is to administer it to a large sample of normal subjects, similar to the target population of aphasia patients in terms of age, sex ratio and educational background. The expectation is that for primary language modalities, there should be no large inter-individual differences in test performances for native speakers of the Thai language. For reading and writing, educational level might however play a role. In addition, it may be the case that subjects not used to being tested formally exhibit minor problems in carrying out the language tasks correctly, in particular when the subjects are quite old. Only if the AAT is standardized on subjects without brain damage can the performances by a patient be interpreted in the light of normal performance.

The objectives of this contribution are:

1. To describe the linguistic properties of the AAT adaption to the Thai language together with giving a rationale for the choice of characteristic language parameters chosen.

2. To investigate the test performances of normal subjects in the Thai version of the AAT with an emphasis on the potential effects of age, sex and educational level.

MATERIAL AND METHOD

Subjects

The sample of normal subjects was composed of 60 females and 60 males, age ranged from 20-70 years with a median of 35 years (mean age 38, SD. 14 years). The subjects were selected from the patients' relatives of the Department of Rehabilitation Medicine, Chulalongkron Hospital. The distribution across age groups followed the proportions in the Thai population[9]. This mean age comparable to the mean age of aphasic patients in Thailand based on the age adjusted prevalence rate of stroke[10]. All were native speakers of the Thai language although they have their own dialects. All could read and write in Thai. They had no hearing or visual problems, using glasses or hearing aids if necessary. Subjects' education level ranged from primary grade 4 to university graduates.

Materials

The AAT is composed of 6 parts. Spontaneous speech in a semi - standardized interview about familiar topics is rated on 6 six-point scale ranging from 0-5. The scales are meant to assess communicative ablilities, articulation and prosody, formulate speech, semantic structure, phonemic structure and syntactic structure of the utterances. The individual scale points are defined *via* qualitative symptoms and their frequency. The spontaneous speech of normal subjects is not assessed since the scales are designed to characterized aphasic expressive language impairments.

The 5 linguistic subtests of the AAT are composed of three to five parts containing 10 items each. The Token Test, original version by De Renzi and Vignolo, 1962, in its 50 item version proposed by Orgass, 1984[8] a test designed to tap auditory language comprehension is included in the AAT because of its good selection properties in discerning aphasic from non-aphasic subjects and also because it is considered the most adequate global measure of the overall level of aphasic impairment. The aphasic test, especially for auditory comprehsion, should be free from unsual lexical

Table 1. Composition of the Aachen Aphasia Test (AAT)

Set up of the Aachen Aphasia Test (AAT)		
Part of test	Components	Scoring per scale / item
1. Spontaneous Speech	6 rating scales	0 - 5
2. Token Test	5 parts \ 10 items	0 / 1
3. Subtest Repetition	5 parts \ 10 items	0 - 3
4. Subtest Written Language	3 parts \ 10 items	0 - 3
5. Subtest Confrontation. Naming	4 parts \ 10 items	0 - 3
6. Subtest Comprehension	4 parts \ 10 items	0 - 3

items or syntactic structures[11,12]. There were the problems in adapting this subtest to the Thai language by varying syntactic construction, e.g. items 7 and 10 in part 5.

7. หลังจากหยิบสี่เหลี่ยมสีเหลืองแล้ว ให้แตะวงกลมสีขาว
   Beruehren Sie den weissen Kreis, nachdem Sie das glelbe Viereck fortgenommen haben.
   (After you have taken the yellow square, touch the white circle.)
10. หยิบสี่เหลี่ยมสีขาว ก่อนจะแตะวงกลมสีเขียว
    Bevor Sie den gruenen Kreis beruehren, nehemen Sie das weisse Viereck.
    (Take the white square, before you touch the green circle.)

And the problems in interpretation of the word "oder" (or) in item 2 of part 5. This item was adapted as:

5. วางวงกลมสีน้ำเงินสลับที่กับสี่เหลี่ยมสีเหลือง
   (Change the place of the blue circle and the yellow square.)

The linguistic structure of the AAT test items can be characterized using the following facet theory oriented definition of language test items : An item belongs to the universe of language test items if its domain concerns a (phonological, semantic, syntactic) regularity on the (phoneme, word, sentence) level and it calls for a response toward that linguistic unit in a (expressive, receptive) language modality and its response range is ordered from very correct to very wrong with respect to that linguistic regularity. A general property of language test items is that facets regularity and unit cannot be fully crossed. Particular phonemic or graphimic or grapheme, morphological, semantic, and syntactic regularities are tied to particular linguistic units, i.e. phonemes or graphemes, morphemes, lexemes or sentences. This fact can be accounted for by introducing one combined facet "linguistic processing complexity" which can be crossed with the modality facet. The parts of each subtest are ordered according to complexity, e.g. from sounds, *via* simple nouns, loan-and foreign words, compound nouns to sentences in the subtest Repetition, or from simple nouns, *via* coulour terms, compound nouns, and sentences in the subtest Confrontation Naming. Within test parts the 10 items often are also ordered with respect to increasing processing difficulty. As in the subtest Written language, not only the increasing of difficulty are from item to item but also the items in the three parts of the subtest are as parallel as possible.

The Written Language ; the items 1, 3 and 9 of 3 subtests

1 Reading aloud
   1. ว่าว [wa^:w]...kite
   3. พลู [phu:]..a kind of leaf
   9. เธออยากได้วิทยุเครื่องใหม่
   (She wants a new radio.)

2. Putting together
   1. ข้าว [kha^:w]..rice
   3. แผล [phx:^]..wound
   9. เธอซื้อบ้านหลังใหม่
   (She buys a new house.)

3. Dictation
   1. ดาว [da:w]..star
   3. พลุ [phu']..firework
   9. เธอมีดินสอแท่งเดียว
   (She has a pencil.)

Obviously, processing complexity is tied to specific characteristics of the particular. It may well be that some specific parameter or characteristic is not present in some language and realized in a different way, e.g. processing difficulty in part 2 of subtest Repetition is introduced in the German original by increasing the number of consonants at the beginning and / or at the end of the nouns to be pronounced from item 1 'Ast' (structure VCC; brance) to item 10 'Strumpf' (CCCVCCC; stocking). In the Thai language, the structure of words initiates only with consonant and there is no consonant clusters in the final position[13]. Therefore, the following parameter was varied : from the item 1 'ฟ้า' (structure CV; sky), item 5 'เชือก' (CVVC; string) and item 10 'เกวียน' (CCVVC; cart).

Another aspect of adaptation is related to sociocultural aspect, e.g. in the subtest Confrontation Naming in which subjects have to name a visually presented line drawing of an object (part 1 and part 3) a colour (part 2) or an action (part 4) several line drawing had to be changed.

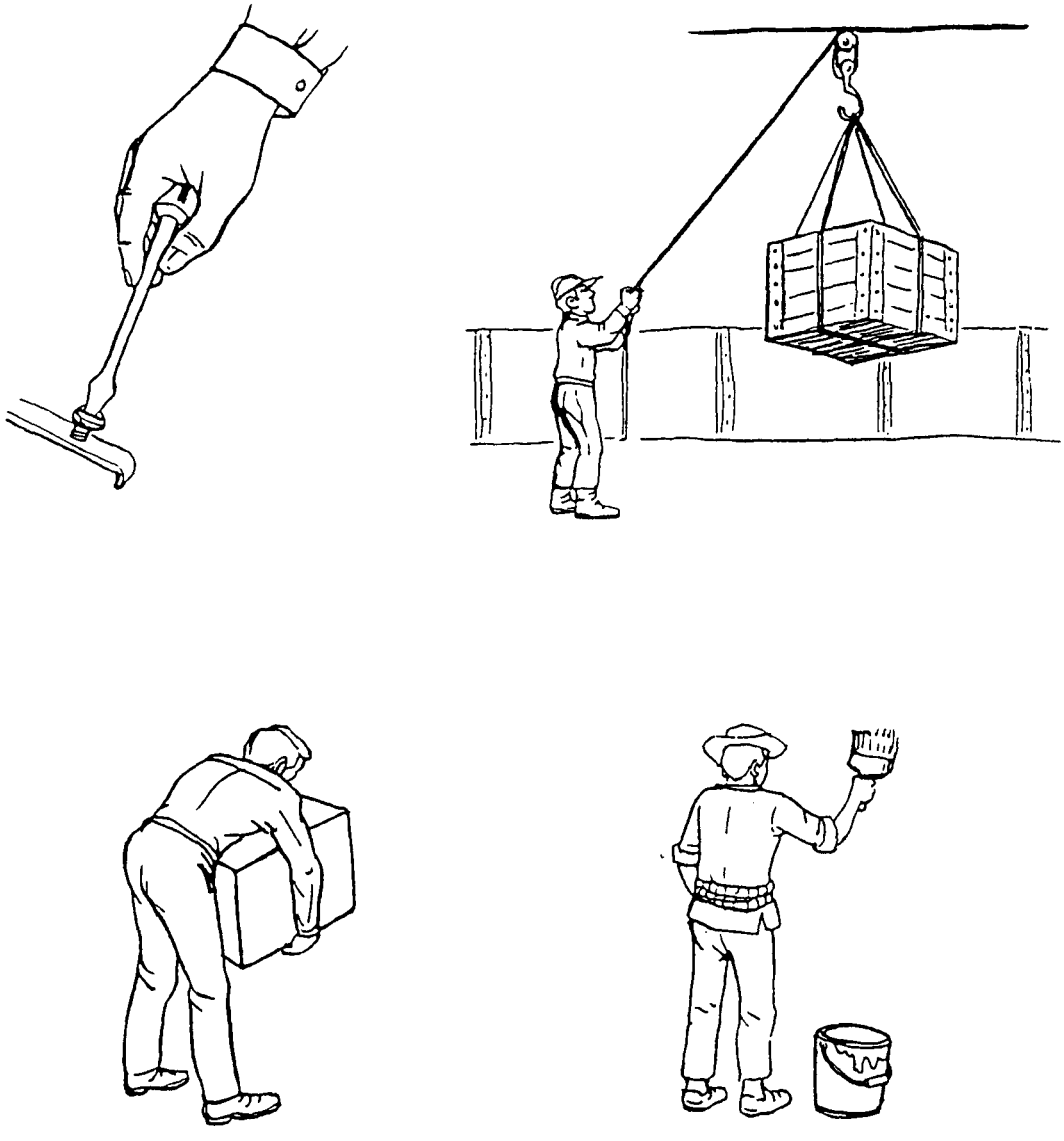

Fig. 1. Item 3 of part 1. Auditory Comprehension : word level ; " ดึงขึ้น " (pull up).

Fig. 2. Item 2 of part 2. Auditory Comprehension : sentence level ; " เธอรู้สึกล้าแล้ว " (She has already been very fatique.).

Except for the pass / fail scoring of the Token Test an ordinal 4 point scale ranging from 0 to 3 used for each subtest of the AAT. The grade scores are intended to denote the varying degrees of similarity of the responses with the target response which may vary from no or a vastly deviant response (score 0) to a correct response (score 3). The intermediate scores 1 and 2 indicate decreasing degrees of deviation from the target according to fixed linguistic critiria. A score of 2 is also given for correct responses after self-corrections or a request for a second presentation of a stimulus, both of which may be indicative of minor language processing problems as well.

Administration and scoring

The AAT examinations were carried out in a separate, quiet and well illuminated testing room. Subjects sat in a comfortable chair in front of a table with the examiner on the opposite side. The testing materials were placed on the table in front of the subject and auditory stimuli were presented verbally by the examiner in a neutral voice. A tape recorder was also placed on the table without attracting the subject's attention. All expressive language responses are thus recorded on tape, so that scoring of responses need not be judged during testing. This is particularly useful for the complex scoring of spontaneous speech and for responses which are not well intelligible.

In the subsequent analyses item scores as well as total scores for subtest parts and whole subject totals were considered. Since only normal subjects were examined in this study it was already expected that most items would be responded to correctly leading to a majority of subject totals close to or identical to the maximum score (resp. minimum error score for the Token Test).

RESULTS

Demographic variables

The distribution of males and females accorrding to level of education and self-reported reading and writing abilities is given in Table 2.

There is no significant difference between men and women with respect to the frequency of different educational levels (chi-square = 4.70, df = 2, p = 0.095) although there is a numerical tendency of females to be either in the low or in the high education group. Reported reading abilities are significantly different for men and women (chi-square = 6.93, df = 2, p = 0.031) with a higher proportion of females in the lowest reading proficiency group. A similar tendency is present for reported writing abilities, although the differences are only marginally significant (chi-square = 5.10, df = 2, p = 0.078). There is a high concordance between the reading and the writing ability categorization. Only 5 out of the 120 subjects have a discrepancy, with the reading ability reported to be one category above writing abilities. There is a clear relation between educational level and reading and writing abilities as revealed in Table 3.

Table 2. Distribution of male and female subjects according to educational level, reading and writing ability.

	Education (years)			
	4 - 10	11 - 16	>16	Total
Male	17 (28.3%)	25 (41.7%)	18 (30.0%)	60
Female	24 (40.0%)	14 (23.3%)	22 (36.7%)	60
Total	41	39	40	120
	Reading Ability			
	No	Some	Yes	
Male	9 (15%)	12 (20%)	39 (65%)	60
Female	20 (33.3%)	14 (23.3%)	26 (43.3%)	60
Total	29	26	65	120
	Writing Ability			
	No	Some	Yes	
Male	12 (20%)	10 (16.7%)	38 (63.3%)	60
Female	21 (35%)	13 (21.7%)	26 (43.3%)	60
Total	33	23	64	120

Table 3. Relation between educational level and reading and writing abilities.

		Reading Ability			Writing Ability		
		No	Some	Yes	No	Some	Yes
Education (years)	4 - 10	27	13	1	29	11	1
	11 - 16	2	8	29	4	7	28
	> 16	0	5	30	0	5	35

Table 4. Relation between speaking a dialect or another language in addition to Thai and educational level, reading and writing abilities.

		Dialect				Dialect				Dialect		
		No	Yes			No	Yes			No	Yes	
Education (years)	4 - 10	37	4	41	Reading no	30	3	33	Writing no	26	3	29
	11 - 16	26	13	39	Ability some	20	3	23	Ability some	23	3	26
	> 16	34	16	50	yes	47	17	64	yes	48	17	65

Table 5. Descriptive statistics for the AAT subtest performances of the normal control subjects.

Subtest	Mean (S.D) Median (mi-max)		Percentile 25	 10	 5
Token Test (error)	1.1	(2.1)	1	4	6
	0	(0-11)			
Repetion	149.3	(1.6)	149	148	147
	150	(139-150)			
Written Language	88.9	(1.9)	88	86	84
	90	(81-89)			
Confront.Naming	119.3	(1.4)	119	117	117
	120	(111-120)			
Comprehension	116.2	(3.7)	114	111	108
	118	(102-120)			

It is interesting to note that 5 subjects report only some reading and writing abilities, although they had at least 17 years of schooling. The distiction between no and some reading and writing abilities is less clear among subjects with only 4 - 10 years in school. There are also some interesting tendencies for the relation between speaking a dialect or another language and the amount of schooling as well as the ability to read and write as indicated in Table 4.

The frequency of speaking a dialect or second language is especially low in the group with only up to ten years of schooling. There is also a tendency for subjects speaking a dialect or a second language to report better reading and writing abilities more often.

AAT test performances

As argued above it was expected that normal subjects would in principle be able to respond correctly to the tasks in an aphasia test. Indeed the variability in performance was low and mean performance was close to the maximum score attainable. This can be seen in Table 5. which gives descriptive information on the distribution of subtest total scores.

The table also gives the total scores related to the 25th, 10th and 5th percentile which are

quite often used as conventional cut-off values to separate normal from subnormal performance, e.g. only 5 per cent of the normal subjects score below a total of 84 in the subtest Written Language. If one compares the 10th and 5th percentile for Thai subjects with the normal rangae reported for a sample of 100 German non-aphasic patients and normal controls taken together the 10th and 5th percentile for Thai normal subjects are very reasonable.

In addition, inspection of performances per individual test item is required to possibly detect items which might be too easy or too difficult empirically, compared to what one might expect from their constructional properties. Due to space limitations this topic cannot be elaborated on in detail here. Summing up, visual inspection of the pattern of performances looks quite promising so that a reasonable gradation of item difficulty can be expected for aphasic patients.

Influencec of demographic variables on the AAT performances

Correlation of the AAT subtest performances and age was examined using Spearman's rank corrlation coefficient because of the highly

Table 6. Spearman rank correlation between age and level of performance in the AAT- subtests.

	Token	Repetion	Written Language	Confront. Naming	Comprehension
Age (years)	- 0.32	- 0.30	- 0.42	- 0.06 (n.s.)	- 0.41

$p < 0.001$ n.s. not significantly different from zero

Table 7. Influence of educational level on AAT subtest performances; left part: descriptive statistics; mean and rang right part; result of Kruskal - Wallis test and multiple pairwise comparisons.

	Educational level (years)			Kruskal Willis test		Pairwise comparisons U - tests (1)
Part of subtest	1 4-10	2 11-16	3 >16	H	P	
Token test	2.5 (11-0)	0.6 (6-0)	0.2 (1-0)	32.0	<0.0001	1 2 3
Repetion	148.3 (139-150)	149.8 (148-150)	149.9 (148-150)	31.2	<0.0001	1 2 3
Written Lang.	87.2 (81-90)	89.6 (87-90)	89.8 (88-90)	51.2	<0.0001	1 2 3
Confront. Naming	119.0 (113-120)	119.5 (117-120)	119.4 (111-120)	2.3	n.s.	
Comprehension	113.9 (102-120)	116.9 (105-120)	117.9 (112-120)	28.0	<0.0001	1 2 3
Reading aloud	29.4 (27-30)	29.9 (29-30)	29.9 (29-30)	23.1	<0.0001	1 2 3
Putting together	29.7 (27-30)	29.9 (28-30)	30.0 (30-30)	9.3	0.01	1 2 3
Dictation	28.1 (24-30)	29.7 (27-30)	29.9 (28-30)	51.7	<0.0001	1 2 3
Auditory Comprehension	57.2 (47-60)	58.6 (49-60)	59.4 (56-60)	24.9	<0.0001	1 2 3
Reading Comprehensio	56.7 (50-60)	58.7 (52-60)	58.5 (54-60)	11.4	0.0004	1 2 3

(1) P - values of U - tests adjusted according to Holm's sequential multiple test procedure; groups not significantly different are underlined with a common line

skewed distribution of subtest performances. As can be seen from Table 6, there is a significant correlation with age in that older subjects tend to perform poorer. These correlation coefficients are never larger than about 0.4, though, indicating a rather modest relation. The only exception is naming performance for which there is no correlation with age at all.

There are no sizeable sex differences either. The difference in mean performance between woman and men is never larger than 1 raw score for any of the subtests and never significant (Mann-Whitney U-tests: all $p > 0.10$).

Educational level and self reported reading and writing proficiency, however have an influence on the AAT subtest performances in normal subjects (Tables 7 - 9). Again, mean differences between the poorest and the best performing group are not large. No difference in means is larger than 5 raw scores as obtained for subtest Comprehension when grouping subject according to self-reported writing ability. Nevertheless, significant differences were found for all subtests except for confrontation naming. The reason is that the mean performance of the poorest group in terms of educational level of reading or writing ability is already very close to the maximum score of 120. Tables 7 - 9 also provide information of the three parts of subtest Written Language separately as well as on auditory and written comprehension. In general, pairwise comparisons subsequent to a significant overall comparison of all three groups according to the Kruskal-Wallis rank test employing U - tests and an adjustment of individual one-tailed p-values using the procedure of Holm (1979) for an overall type-I error level of 5 per cent per subtest (subtest part) revealed that the least well educated group, represented the group of subjects with low or no reading or writing abilities, was often scoring below the other two groups.

Besides confrontation naming the only other exception is putting together of graphemes or words to words or sentences which is performed very well also for the poorest group. Differences

Table 8. Influence of self reported reading ability on AAT subtest performanced ; ..... (see Table 7.)

Part of subtest	Reading Ability 1 No	2 Some	3 Yes	Kruskal - Wallis test H	P	Pairwise Comparison U - tests (1) 1	2	3
Token Test	3.0 (11-0)	1.1 (6-0)	0.3 (3-0)	27.1	<0.0001	1	2	3
Repetion	148.3 (142-150)	149.2 (139-150)	149.8 (148-150)	24.5	<0.0001	1	2	3
Written Lang.	86.7 (81-90)	89.2 (86-90)	89.7 (87-90)	45.6	<0.0001	1	2	3
Confront. Naming	118.9 (116-120)	119.2 (117-120)	119.5 (111-120)	6.6	0.037	1	2	3
Comprehension	113.0 (102-120)	115.7 (105-120)	117.8 (112-120)	34.0	<0.0001	1	2	3
Reading aloud	29.9 (27-30)	29.9 (28-30)	29.9 (29-30)	35.1	<0.0001	1	2	3
Putting together	29.8 (27-30)	29.8 (29-30)	29.9 (28-30)	3.5	n.s.			
Dictation	27.8 (24-30)	29.4 (27-30)	29.8 (27-30)	47.2	<0.0001	1	2	3
Auditory Comprehension	56.7 (47-60)	57.9 (49-60)	59.3 (56-60)	29.9	<0.0001	1	2	3
Reading Comprehension	56.3 (50-60)	57.8 (52-60)	58.5 (54-60)	13.8	0.001	1	2	3

(1) see Table 7

Table 9. Influence of self reported writing ability on AAT subtest performances, ...see Table 7.

Part of subtest	Writing Ability 1 No	2 Some	3 Yes	Kruskal - Wallis test H	P	Pairwise Comparison U - test (1) 1	2	3
Token Test	3.1 (11-0)	0.6 (4-0)	0.2 (3-0)	32.5	<0.0001	1	2	3
Repetion	148.1 (139-150)	149.7 (148-150)	149.8 (148-150)	27.8	<0.0001	1	2	3
Written Lang.	86.9 (81-90)	89.3 (86-90)	89.7 (87-90)	49.9	<0.0001	1	2	3
Confront.Naming	119.0 (113-120)	119.1 (117-120)	119.5 (111-120)	6.5	0.039	1	2	3
Comprehension	112.9 (102-120)	116.2 (105-120)	117.9 (112-120)	38.5	<0.0001	1	2	3
Reading aloud	29.3 (27-30)	29.9 (28-30)	29.9 (29-30)	28.1	<0.0001	1	2	3
Putting together	29.8 (27-30)	29.9 (29-30)	29.9 (28-30)	3.4	n.s.			
Dictation	27.9 (27-30)	29.6 (27-30)	29.8 (27-30)	53.3	<0.0001	1	2	3
Auditory Comprehension	56.6 (47-60)	58.2 (49-60)	59.4 (56-60)	33.3	<0.0001	1	2	3
Reading Comprehension	56.3 (50-60)	57.0 (52-60)	58.5 (54-60)	12.7	0.0002	1	2	3

(1) .....see Table 7

between middle and high educational level are never present. The only significant differences between the two upper reading or writing level were found for the Token Test and subtest Comprehension, in particular auditory comprehension.

DISCUSSION

One of the most critical problems in understanding language disorders came from the difficulty of properly distinguishing normal communication process. The appropriate way is to describe the normal response, so that the characteristic of aphasic patients' performances are able to be precisely described[6,14]. In Aphasiology the deployment of linguistic theories of normal language function may be used to explain or predict language impairment in aphasic subjects[15]. From this study the characteristic language parameters of the normal subjects were described for an baseline of the AAT-Thai version. It revealed that their communicative ability were independent of age, sex and education level. There was an influence of educational level, reading and writing abilities only on those test parts, which require reading and/or writing, as well as general cognitive abilites in subtest comprehension, which is a metalinguistic task, Token Test, which is auditory comprehension, and parts of repetition, which require verbal working memory. But there was no influence of these varibles on comfrontation naming.

The Thai Version of the German Aachen Aphasia Test appeared to be free of linguistic factors, i.e. it had been used sucessfully for Thai normal subjects, who speak dialect or another language. So this test are not bias by linguistic factor for the aphasic patients and appropriate for differential diagnosis as well.

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แบบทดสอบอาเค่นอะเฟเซีย ฉบับภาษาไทย

นันทนา ประชาฤทธิ์ภักดี, ศศ.ม. , กัมมันต์ พันธุมจินดา, พ.บ.***

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แบบทดสอบอาเค่นอะเฟเซีย เป็นแบบทดสอบมาตรฐาน สำหรับประเมินความสามารถทางภาษาของผู้ป่วยอะเฟเซียเยอรมัน ซึ่งประกอบด้วย การทดสอบการพูดเอง และส่วนทดสอบย่อย 5 ส่วน ได้แก่ แบบทดสอบโทเก่น, การพูดตาม, ภาษาเขียน, การเรียกชื่อ และความเข้าใจภาษา. จุดประสงค์ของการศึกษาครั้งนี้เพื่อแสดงลักษณะของแบบทดสอบฉบับภาษาไทย พร้อมทั้งศึกษาลักษณะของการตอบสนอง ต่อการทำแบบทดสอบของคนไทยปรกติ ในบทความนี้ ได้กล่าวถึงปัญหา และการเปลี่ยนแปลงทางภาษาในการพัฒนาแบบทดสอบฉบับภาษาไทย ผลศึกษาพบว่า ความสามารถในการทำแบบทดสอบของคนไทยปรกติ ไม่ขึ้นกับ วัย เพศ และ ระดับการศึกษา ดังนั้นแบบทดสอบอาเค่นอะเฟเซียฉบับภาษาไทย จึงมีความเหมาะสมสำหรับเป็นแบบทดสอบประเมินความสามารถทางภาษาของผู้ป่วยอะเฟเซียไทย

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