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The Communicative Effectiveness Index: Psychometric properties of a Danish adaptation

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The study investigated the psychometric characteristics of a Danish adaptation and translation of the Communicative Effectiveness Index (CETI). A total of 68 patients with left hemisphere strokes, who had aphasia on admission, were assessed with the CETI at least 1 year after stroke, when 53 of them were still aphasic. Language functions were also assessed with the Western Aphasia Battery (WAB) in 65 and the Porch Index of Communicative Abilities (PICA) in 33 patients. After about 4 months 19 patients were retested in order to compare sensitivity to chance in language function. Activities of daily living were assessed with the Barthel Index (BI) and the Frenchay Activities Index (FAI), and depression was assessed with an illustrated, seven-item visual-analogue scale in a subset of the patients. Reliability measured as internal consistency was satisfactory and on the level of the original standardisation. The 3½ month test–retest reliability was lower than in the WAB and the PICA when measured by correlation coefficients, but this might express real communication improvements in some patients that are not reflected in their aphasia scores. Concerning validity, the CETI had high correlations with WAB and PICA. Factor analysis suggests two factors which are interpreted as: (1) ability to formulate spoken language; and (2) ability to communicate by nonverbal means. It is concluded that the CETI can be adapted to other languages without major problems. Its general validity as a measure of functional communication is supported by the analysis of the translated version.

The traditional syndrome-oriented approach to aphasia assessment has been under attack for some time from several sources. From cognitive neuropsychology it has been judged insufficient for elucidating the details of the language system necessary for rational planning of therapy (Byng, Kay, Edmundson, & Scott, 1990). From the opposite corner it has been claimed that focus on the total communication situation is more important, determining how the aphasic person might communicate with any means at his or her disposal and, thus, that assessment should be on performance rather than potential (Lomas et al., 1989). Theoretically advanced variations of this approach are found in recent developments in conversational analysis (Crockford & Lesser, 1994) and the related field of pragmatics (Lesser & Milroy, 1993). The current emphasis on quality assurance in health systems and on continuous monitoring of rehabilitation programmes

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by means of simple, yet reliable and valid functional evaluation scales has revived interest in functional assessment in aphasia (Frattali, 1992).

Several attempts at functional assessment of communication have been made through adapted traditional testing (Porch, 1967) or role-playing situations (FCP by Sarno and CADL by Holland, see Davis, 1993). However, these have been criticised for being too closely related to traditional measures of language function and for not being well investigated psychometrically (Lomas et al., 1989). An ingenious new test, the Communicative Effectiveness Index (CETI), was developed by Lomas et al. (1989). With the CETI, a relative of the aphasic person rates communication functions by means of a visual-analogue rating scale, and the test has been especially designed to allow detection of change in function. Previous experience suggests that the CETI could be robust to translation and adaptation to other languages and cultures (Penn, Milner, & Fridjhon, 1992). It was therefore chosen as one of the outcome measures for a randomised, placebo-controlled group study of computer-rehabilitation of aphasia. An evaluation of the Danish translation and adaptation of the CETI is presented here.

METHODS

Patients

We included 68 patients who had a stroke with aphasia at least 1 year before the assessments in the present study. The patients were selected from a population included in an aphasia rehabilitation study that will be reported elsewhere. They were recruited from the stroke units of three Copenhagen hospitals (Bispebjerg, Hvidovre, and Frederiksberg) and from the Danish Stroke and Aphasia Association (Hjernesagen). All patients had Danish as their first language and none had a diagnosis of dementia prior to their stroke. Basic patient characteristics are listed in Table 1. Mean age at stroke onset

TABLE 1
Basic patient characteristics and test results

Pt no.	*Age*[$]	*Sex*	*Chronicity*[#]	*Type of aphasia*	*WAB AQ*	*CETI*	*PICA*
1	71	male	558	anomic	80.10	45.00	11.03
2	72	female	454	Broca's	14.20	24.60	8.40
3	45	female	1895	Broca's	16.20	47.40	6.78
4	82	female	364	anomic	89.70	86.30	13.36
5	76	female	557	Broca's	31.50	8.40	4.96
6	67	female	471	global	13.20	64.75	7.37
7	59	female	369	transc. motor	71.70	72.88	9.81
8	82	male	402	Wernicke's	25.90	37.80	4.91
9	85	female	431	Wernicke's	41.70	47.10	8.92
10	78	male	390	no aphasia	96.20	75.69	—
11	78	female	429	no aphasia	96.70	57.56	—
12	60	male	421	Broca's	19.50	41.90	8.44
13	81	male	409	anomic	91.70	38.50	11.74
14	78	female	387	no aphasia	96.80	87.38	—
15	67	male	730	conduction	85.80	74.75	—
16	77	male	358	Broca's	61.70	27.00	—
17	83	female	360	no aphasia	95.80	92.10	—
18	74	female	350	Broca's	35.50	50.50	7.61
19	70	male	663	conduction	79.80	55.80	12.88

(Continued)

TABLE 1
(Continued)

Pt no.	*Age*[$]	*Sex*	*Chronicity*[#]	*Type of aphasia*	*WAB AQ*	*CETI*	*PICA*
20	77	male	375	no aphasia	96.00	86.70	—
21	76	female	362	Broca's	16.40	18.20	3.73
22	83	female	361	global	4.20	12.30	—
23	72	female	447	(global)*	—	6.40	—
24	83	male	428	no aphasia	97.80	100.00	—
25	49	male	411	Broca's	39.30	31.40	9.27
26	84	female	471	anomic	80.80	39.80	12.04
27	75	male	394	no aphasia	96.00	82.20	—
28	78	female	388	anomic	64.80	39.63	—
29	73	female	363	no aphasia	96.30	87.30	—
30	73	female	369	Wernicke's	26.00	36.10	—
31	84	female	355	anomic	91.40	79.10	—
32	69	male	401	Broca's	20.90	38.80	—
33	76	female	418	anomic	86.70	51.60	—
34	83	male	440	anomic	89.70	70.40	—
35	83	female	447	Broca's	33.40	36.13	—
36	78	male	369	anomic	80.20	67.30	11.70
37	84	male	353	no aphasia	94.20	61.88	—
38	66	female	359	anomic	91.20	43.25	—
39	70	female	401	anomic	89.20	65.48	—
40	69	male	366	no aphasia	98.00	100.00	—
41	77	female	420	Wernicke's	42.10	28.88	8.11
42	46	male	370	no aphasia	95.30	76.10	—
43	79	male	444	(global)*	—	11.38	—
44	82	male	362	global	13.10	46.50	—
45	88	male	366	Broca's	40.10	36.40	—
46	78	male	394	—	—	12.25	—
47	74	male	349	Broca's	19.40	40.10	8.48
48	71	male	369	global	8.80	18.60	—
49	76	female	363	no aphasia	99.60	89.63	—
50	74	female	400	anomic	89.60	74.90	—
51	83	female	365	Wernicke's	23.90	0.00	3.39
52	93	female	376	anomic	91.30	100.00	—
53	78	female	395	global	1.70	31.10	9.24
54	66	female	400	Broca's	35.90	16.60	8.19
55	58	male	376	Broca's	22.50	31.30	—
56	70	male	362	no aphasia	94.50	93.80	—
57	65	female	355	anomic	89.90	76.70	—
58	64	male	356	transc. motor	53.50	37.70	9.49
59	67	male	2229	global	0.50	11.40	4.66
60	70	male	442	conduction	52.60	36.40	11.52
61	67	female	1860	Broca's	68.30	37.10	12.11
62	75	male	1493	Broca's	22.50	31.60	8.24
63	60	female	3694	Broca's	60.50	64.30	10.52
64	59	male	1946	anomic	82.60	59.80	12.16
65	58	female	4127	conduction	87.20	50.60	13.28
66	58	male	616	Broca's	54.60	65.19	9.84
67	52	male	1569	Wernicke's	65.20	21.50	9.21
68	76	male	1566	Broca's	25.20	37.70	7.98

[$] age at stroke onset

[#] days from stroke onset to CETI assessment

* refused to cooperate with the WAB, AQ probably not beyond 10 in either case

transc. motor = transcortical motor aphasia.

was 72.6 years (SD 10.0) and 49% were males. Median time since stroke onset was 400 days (mean 656 days, SD 719), 19% had a previous stroke and 5% had aphasia before their last stroke. At the time of the assessments 30% of the patients were living in nursing homes, and 53% were widowed or living alone for other reasons. One patient (no. 60 on Table 1) became worse on all measures during a longer period in which we followed him, and is probably in the process of developing a dementia of Alzheimer's type in addition to the stroke sequelae. Of the patients studied, 66 had left hemisphere strokes and 2 had bilateral strokes; 6 had a previous right hemisphere stroke.

Instruments

Three instruments for assessments in aphasia were translated and adapted for the present study: The Communicative Effectiveness Index (CETI: Lomas et al., 1989), The Western Aphasia Battery (WAB: Kertesz, 1982), and The Porch Index of Communicative Abilities (PICA: Porch, 1967). The properties of the translated WAB and PICA will be reported elsewhere. The translated text for the CETI is shown in Appendix A. A subset of the patients was assessed for stroke severity, depression, and activities of daily living (ADL). Depression was assessed by an instrument constructed for this study: The Non-verbal Index of Depression (NID). Seven items from the revised Beck Depression Inventory (Beck, Rush, Shaw, & Emery, 1979) that could be illustrated relatively unambiguously were used for a non-verbal test with a visual-analogue scale and drawings illustrating the endpoints. The illustrated BDI items are listed in Appendix B. The score ranges from 0 to 100 (0 is least depressed mood). We chose to use this instrument, in spite of the lack of data on validity and reliability, because few other options for assessing depressive mood with aphasic patients are available. Both attempts of which we are aware have used very simple ''smiley''-like drawings for the endpoints of the visual-analogue scales (Code & Müller, 1992; Stern et al., 1997). We chose to use more naturalistic drawings. Stroke severity was assessed with the Scandinavian Stroke Scale (SSS) that ranges from 0 to 58 (Lindenstrøm et al., 1991; Scandinavian Stroke Study Group, 1985). Activities of daily living (ADL) were assessed with the Barthel Index (BI) that ranges from 0 to 100 (Mahoney & Barthel, 1965) and the Frenchay Activity Index (FAI) that ranges from 15 to 75 (Pedersen et al., 1997; Wade, Legh-Smith, & Langton-Hewer, 1985).

Assessments

All 68 patients had at least one assessment with the CETI; 20 of the patients had two assessments. A total of 65 patients were also assessed with the first part of the WAB, sufficient to determine the Aphasia Quotient (AQ, ranging 0–100 with AQ above 93.8 considered non-aphasic) and with the second part of the WAB comprising reading, writing, and non-verbal tests: apraxia, drawing, construction, calculation, and Raven Coloured Matrices (RCM); 33 patients were assessed with the PICA; 29 patients were assessed for depressive mood with the NID; in 38 patients stroke severity was rated with SSS; in 37 patients basic ADL was rated with BI; and in 36 patients higher level ADL was rated with FAI.

Statistics

Comparisons for repeated tests were carried out with Students' paired *t*-test. Univariate correlations were performed with the Pearson correlation coefficient. Explorative factor analysis was carried out with principal components analysis. All factors with an

eigenvalue > 1 were retained and subjected to oblique rotation using the Direct Oblimin procedure (verified by visual inspection of a scree plot). The required two-tailed significance level for all statistical tests was set to .05. All analyses were performed with the SPSS for Windows v. 10 statistical package (SPSS Inc., 1999).

RESULTS

WAB, CETI, and PICA scores for the individual patients are shown in Table 1. The distribution of CETI scores is shown in Figure 1. Mean CETI score was 50.4 (SD 26.4, range 0–100); mean WAB AQ was 59.6 (SD 33.0, range 0.5–99.6); and mean PICA raw total score was 9.07 (SD 2.71, range 3.39–13.36). According to the actuarial WAB classification, 6 patients (9%) had global aphasia, 19 (29%) Broca's, 2 (3%) transcortical motor, 6 (9%) Wernicke's, 4 (6%) conduction, 15 (23%) anomic, and 13 (19%) no aphasia. Two additional patients were judged to have global aphasia on the basis of a partial WAB and clinical impression.

Reliability

Table 2 shows the mean scores for individual CETI items and their corrected correlations with the total score. The internal consistency of the CETI scale is found to be high, as Cronbach's alpha is .96. Item 13 has the lowest corrected correlation with the total score. It could be claimed that this item is also of the least ''functional'' nature

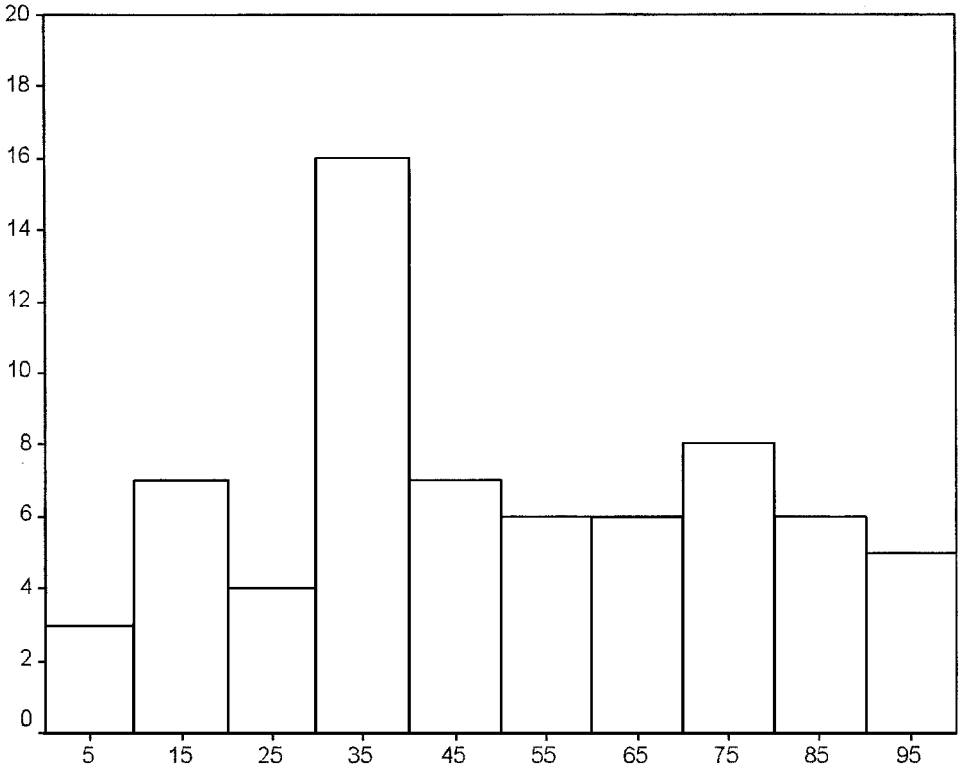

Figure 1. Histogram of the distribution of CETI scores at the first assessment.

TABLE 2
Characteristics of the individual CETI items

Item no.	*Item scores*		*Item-total correlation*[#]
	Mean	*SD*	
1	65.6	29.9	0.64
2	43.4	34.5	0.84
3	55.9	30.8	0.75
4	59.6	32.0	0.75
5	67.9	25.3	0.68
6	56.9	33.1	0.80
7	55.0	34.2	0.86
8	45.1	36.8	0.80
9	63.9	30.9	0.71
10	43.4	36.5	0.87
11	56.9	30.7	0.74
12	40.0	36.4	0.83
13	52.6	32.7	0.48
14	30.3	32.2	0.84
15	38.9	34.0	0.87
16	30.2	34.2	0.85

N = 68
[#] Corrected correlation of item with total score.

(''Understanding writing'') of the 16 items. The last three items are the most ''difficult'' and have the lowest mean scores. The three ''easiest'' items are items 2, 5, and 9.

Table 3 shows the test–retest change scores for 19 patients for whom CETI, WAB, and PICA were performed twice with about 3½ months between. Of the 19 patients, 14 have greater differences in the CETI than in the WAB. There are, however, some cases in which the WAB difference is much greater than the CETI difference. A similar picture is seen with the PICA. Most surprising, the differences are in opposite directions in several cases. The test–retest correlation is .86 for the CETI, .96 for the WAB, and .96 for the PICA, and only the CETI has a significant change in mean score (Table 4). The correlation of the change in CETI and in WAB AQ is insignificant ($r = .16$) as is also the correlation with the PICA change ($r = .03$). It should be noted that the WAB AQ and the PICA change scores have a significant negative correlation ($r = -.49$, $p = .03$).

Validity

The results of a factor-analysis of the CETI items are presented in Table 5. The figures represent the factor loadings (structure matrix) after an oblique rotation in order to optimise separation of the factors. A two-factor structure was found. The first factor could be interpreted as covering verbal communication and the second factor non-verbal communication

Table 6 shows correlation of the CETI with aphasia tests and tests of non-verbal cognitive functions. The correlations of CETI with WAB and PICA are lower than the correlation between these two traditional aphasia tests, which is .85 ($p < .001$). The Information score was included in the WAB as a measure of functional communication (Kertesz, 1982). However, the correlation of this score with the CETI is the same as the correlation of the CETI with the WAB Fluency score. The correlation of the CETI with

TABLE 3
Change scores for each patient with repeated CETI, WAB, and PICA*

Pt. no	*CETI*	*WAB AQ*	*Recalc PICA**	*Raw PICA*
2	6.5	29.9	−11.9	−1.70
3	5.4	−0.7	3.9	0.54
6	9.0	2.4	−0.4	−0.05
8	9.2	−0.9	3.7	0.52
12	3.5	−4.8	1.6	0.22
13	7.5	−3.2	−6.5	−0.91
21	3.2	−0.3	3.7	0.52
25	14.9	8.8	−2.1	−0.30
41	20.37	6.0	3.0	0.42
55	26.45	−5.1	3.4	0.47
59	13.5	−0.2	−5.2	−0.73
60	−10.3	−8.4	−6.1	−0.86
61	3.3	2.3	0.1	0.01
62	6.3	−1.8	2.7	0.38
63	1.4	3.7	3.9	0.55
64	7.5	8.2	−0.8	−0.11
65	10.1	−4.8	3.7	0.52
67	−3.2	−3.8	6.3	0.88
68	1.6	−0.3	8.7	1.22

* CETI and WAB spans from 0–100, PICA from 1–15; therefore PICA was recalculated as follows: (PICA − 1) × 7.143 in order to be comparable.

TABLE 4
Change in mean scores for CETI, WAB, and PICA

	First Assessment	*Second Assessment*	*Statistics**
CETI	37.6 (14.7)	44.8 (15.9)	$t = 3.8$, $p = .001$
WAB AQ	40.3 (28.1)	41.7 (28.0)	$t = -0.7$, NS
PICA total raw score	8.77 (2.67)	8.85 (2.64)	$t = -0.5$, NS

N = 19
* paired samples *t*-test

the WAB Comprehension score is even lower. To further elucidate this, we also analysed the correlation of CETI item 5, which is the only item that specifically mentions comprehension, with the WAB Comprehension score. This correlation is relatively low ($r = .40$, $p = .001$).

Correlations of the CETI with the reading and writing parts of WAB are at the same level as with the first part of the WAB. The correlations with WAB calculation and apraxia are only slightly lower. The correlations with the non-verbal WAB sub-tests—block design, drawing, and Raven Coloured Matrices—are much lower, although still significant.

Table 7 shows the correlation of the CETI with sub-test scores of the first part of WAB. A low correlation is found with the repetition score, but this correlation is, in fact, higher than correlation of the repetition score with the WAB AQ ($r = .47$, $p < .001$). Higher correlations ($r > .44$, $p < .01$) between the WAB Repetition and the individual

TABLE 5
Factor-analysis (structure matrix) of the CETI items

Item	*factor 1*	*factor 2*
1	0.49	**0.82**
2	**0.88**	0.64
3	**0.69**	**0.75**
4	0.58	**0.91**
5	0.54	**0.80**
6	**0.79**	0.70
7	**0.84**	0.73
8	**0.86**	0.60
9	0.58	**0.82**
10	**0.90**	0.67
11	0.62	**0.82**
12	**0.83**	0.70
13	0.62	0.25
14	**0.88**	0.64
15	**0.90**	0.69
16	**0.92**	0.60

Factor loadings after oblique rotation.

Factor loadings above 0.75 are boldfaced in order to help interpretation.

TABLE 6
Correlations of the CETI with other tests

Test	*N*	*r*	*Significance*
WAB AQ	65	.76	$p < .001$
PICA total raw score	33	.63	$p < .001$
WAB Reading	61	.70	$p < .001$
WAB Writing	58	.69	$p < .001$
WAB Apraxia	61	.60	$p < .001$
WAB Calculation	60	.64	$p < .001$
WAB Block Design	61	.34	$p < .008$
WAB Drawing	60	.41	$p < .001$
Raven Coloured Matrices	59	.41	$p < .001$

TABLE 7
Correlations of the CETI with WAB sub-scales

Test	*r*	*Significance*
WAB Information	.73	$p < .001$
WAB Fluency	.73	$p < .001$
WAB Comprehension	.65	$p < .001$
WAB Repetition	.53	$p < .001$
WAB Naming	.75	$p < .001$

N = 66

CETI items are found for CETI items 2, 6, 7, 9, 10, 12, 15, and 16. These items all concern the ability to take part in a conversation with one or more persons.

Relationship to stroke severity and activities of daily living

The CETI score is not significantly correlated to either stroke severity (SSS), or basic (BI) or high level (FAI) activities of daily living (see Table 8). This contrasts with both WAB AQ and the PICA total raw scores that are significantly correlated with all three measures. We also included Raven Coloured Matrices (RCM) in this analysis as a measure of non-verbal intellectual status. RCM is not significantly correlated with stroke severity, but it is significantly correlated with the two measures of ADL function.

CETI and depressive mood

Scores for 29 patients on the Non-verbal Index of Depression (NID) ranged from 0.6 to 74.6 (mean 23.4, SD 16.2). The correlation of the NID with CETI was .05 (NS). The correlation of the NID with WAB AQ was −.07 (NS) and with the PICA total raw score it was .01 (NS). One patient (no. 12) with a very high NID score of 74.6 had a higher score on the CETI (41.9) than on the WAB AQ (19.5).

DISCUSSION

The original psychometric evaluation of the CETI was done with 22 aphasic patients (11 recovering and 11 stable; Lomas et al., 1989). The CETI in English, Afrikaans, Sotho, and Zuli was evaluated with 22 aphasic and 6 right hemisphere patients in South Africa (Penn et al., 1992). A detailed analysis of the English CETI compared with other methods was presented by Crockford and Lesser (1994). The present study comprises 68 patients in a stable phase who were or had been aphasic after a left hemisphere stroke (13 were recovered according to the WAB AQ).

Reliability

Reliability expressed as internal consistency was tested by means of Cronbach's alpha. This value is quite high, suggesting the translation to be very reliable and as reliable as the original. Another aspect of reliability is test–retest reliability. Usually, the highest possible test–retest correlation is required, and here our results seem to be disappointing. The CETI has a somewhat lower test–retest correlation than both the WAB AQ and the PICA. There are, however, some complications involved in the meaning of test–retest

TABLE 8
Correlation of CETI, WAB AQ, PICA, and Raven with stroke severity and ADL

	SSS[§]	*BI*[$]	*FAI*[#]
CETI	0.20	0.14	0.34
WAB AQ	0.64***	0.44*	0.50**
PICA total raw score	0.60***	0.47**	0.57**
Raven Coloured Matrices	0.30	0.41*	0.48**

[§] Scandinavian Stroke Scale; [$] Barthel Index; [#] Frenchay Activities Index

* $p < .05$; ** $p < .01$; *** $p < .001$

reliability in our case: (1) About 3½ months elapsed between the test and the retest, and some patients were in rehabilitation; thus, the communication performance might actually have changed for some patients. It should be noted that a test that is more sensitive to small improvements would seem less reliable. (2) Fluctuations in tests scores from one test occasion to another might seem to be an aspect of test–retest reliability. It could, however, be argued that the day-to-day changes in the patients' performances on the aphasia tests are real, and that the patients do in fact fluctuate in their language abilities, suggesting that this would not be a problem of test reliability, but a characteristic of aphasic stroke patients. Such day-to-day fluctuations in performance are a major concern for rehabilitation outcome research because they might obscure gains from rehabilitation, and an instrument that could bypass such fluctuations would be very valuable. Lomas et al. (1989) have argued that CETI's advantage over other instruments such as WAB is that it samples behaviour over a longer time span and thus should be less prone to artifacts from day-to-day fluctuations in the patient's performance caused by fatigue, etc.

We found that the CETI, but neither the WAB nor the PICA, had changed significantly in mean score at retest. This might, as mentioned, be taken as an indication of lower reliability, but another possible interpretation is that the CETI may be more sensitive to change compared to the WAB and the PICA. This interpretation rests on the assumption that the fluctuations in both positive and negative directions in WAB and PICA scores are expressions of day-to-day fluctuations in performance that may mask real improvement. Although all our patients were in a phase where little spontaneous remission in aphasia is expected (consistent with the high test–retest correlations of the WAB and the PICA) there is no reason why the patients' communicative abilities should not continue to develop even quite late after stroke (although this would only lead to a lower test–retest correlation in cases where this development was unequal among the patients).

A more detailed look at the pattern of test–retest scores shows that there are both negative and positive fluctuations in WAB and PICA scores. The CETI scores, on the other hand, have only two negative fluctuations, and one of these is the patient who became worse on all scores during the period, probably because of a developing dementia condition. Thus the CETI shows, for the most part, no change or a positive change, which is what one would expect if some patients were stable and some improved. The WAB and PICA, on the other hand, show apparently random increases and decreases in scores at the retest, which is what one would expect from less reliable tests.

Lomas et al. (1989) found improvements on a retest after 7 weeks in 11 patients first assessed 7 weeks after onset, whereas there was a very stable level on a retest after 8 weeks in 11 patients first assessed about 3 years after onset. Penn et al. (1992) analysed an acute group of four patients less than 6 months post-onset and a stable group of four patients more than 6 months post-onset (up to 6 years). The second assessment was carried out 3–15 months after the initial testing. Improvement on the CETI scores was found in both groups. The rather short retest interval of Lomas et al. (1989) is that normally used for assessment of retest reliability, and indicates a good retest reliability. A much longer retest interval was used in both our study and the study by Penn et al. (1992), making a true change in communicative abilities more likely.

One possible problem with the CETI concerns the rater being allowed to see the previous rating. This is a very non-standard procedure in psychometrics. The danger is that the subjective rating could be influenced by the previous rating and expected changes in the patient rather than by actual changes in the communicative behaviour of the

patient. Unfortunately, whether that is indeed the case cannot be evaluated by the type of data we have in the present study.

Validity

A factor analysis was carried out in order to elucidate *construct validity*. This analysis suggests that there are two underlying factors for the CETI score. Factor 2 has the highest loadings on items 1, 4, 5, 9, and 11, and it is the simplest to interpret, as all these items might be obtained by purely non-verbal means. Factor 1 has highest loadings on items 2, 3, 6, 7, 8, 10, 12, 14, 15, and 16, which all concern situations requiring a verbal output. However, it should be noted that most items have quite high loadings on both factors, so the test cannot simply be split into a verbal and a non-verbal part. Item 13 does not load very high on either factor, which makes sense, as it is the only item dealing with written language. Thus, it seems that the unique contribution of the CETI, beyond what is known from traditional tests, concerns the areas of non-verbal communication.

Concerning *concurrent validity*, there is no ''gold standard'' against which to validate the index, as the original authors have noted (Lomas et al., 1989). Like them, we have compared the scores of the CETI with scores from two traditional aphasia tests—the WAB AQ and the PICA. Both sets of correlations are quite high, and the correlation with the WAB is somewhat higher than that found by Lomas et al. (0.76 compared to 0.61). High correlations with traditional aphasia tests are not necessarily an advantage, as the purpose is not to test the same thing as traditional aphasia tests, but something new: functional communication.

High correlations are also found with WAB calculation and apraxia scores. Calculation is dependent on symbolic manipulation, and the association of apraxia and aphasia is well established (because of anatomical proximity of the responsible brain areas, see Kertesz, Ferro, & Shewan, 1984).

The CETI is not associated with measures of ADL function as are both the WAB AQ and the PICA total score. At first it seems puzzling that a functional communication score should be less associated with activities of daily living than traditional aphasia tests. However, we have previously shown in a large-scale, community-based study of stroke patients that the relationship of aphasia with BI and FAI is best explained by a third common variable, stroke severity (Pedersen et al., 1996a). The results shown in Table 8 could be explained in this way, as there is a very high correlation of stroke severity (SSS) and the two traditional aphasia tests and a low and insignificant correlation of CETI with stroke severity. Our earlier interpretation is that aphasia *per se* is not impairing ADL functioning, and we have also previously presented data suggesting that general intellectual function influences ADL functioning independently of stroke severity (Pedersen et al., 1996b, c). The insignificant correlation of RCM with SSS and the significant correlations of RCM with BI and FI fit with that interpretation. Our conclusion is that the CETI is a measure of *communicative* functioning and not of general ADL functioning, and that CETI measures aspects of communication other than the traditional tests, as there are very different degrees of association with stroke severity. More definitive conclusions regarding the relationship between stroke severity, ADL function, language function, and communication would require a multiple regression analysis. Unfortunately, such an analysis would not be guaranteed to yield stable results with the number of patients for whom we have all the relevant data in this study.

Lomas et al. (1989) noted that the patients' relatives tend to rate comprehension higher than the therapist. We also found a low correlation between the CETI question involving

comprehension and the WAB comprehension score. It could be difficult to decide who is making the more precise judgement. It is well known in cognitive rehabilitation programmes that the scorings of the relatives might decrease while the patient is, in fact, improving, because of increased awareness of the problems brought forth by the interventions (Teasdale et al., 1997).

We found a low correlation of the CETI with the WAB Repetition score, but it was, in fact, higher than the correlation between the WAB Repetition score and the full WAB AQ. This is puzzling. It is obvious that repetition fits poorly with the general construct of aphasia as measured by the WAB. But why should it have a somewhat better relation with functional communication? Several explanations could be suggested. First, it might be an artifact. The repetition ability might give relatives the impression of a better communicative ability than the person really has. We have observed that it means very much to relatives to actually hear the aphasic person say something (a need that sometimes seems to hinder attempts to teach couples or family the augmented and alternative communication techniques). Second, the ability to repeat might really help the aphasic person to take part in a conversation, as association of the repetition score with conversation-oriented items of the CETI suggests. The conventions of conversation mandate that a conversation partner give some kind of response at certain times, and the repetition ability might be associated with this—a hypothesis that it would be very interesting to investigate further with a conversational analysis study.

The distribution of scores

Tests for impairments of language functions in patients with brain lesions are usually not standardised like traditional psychometric tests. To describe the performance of the patient population in terms of *z*-scores (standard deviations) derived from a normal, non-brain-injured population would be meaningless (unfortunately, the problems related to this kind of assessment method seem to have been neglected in the psychometric literature). What is needed instead is a test on which all normal controls would perform perfectly or nearly perfectly. Rather than a normal distribution of scores in normal controls, the aim is to obtain a distribution of scores in patients that is as close to being flat as possible. That would show that there are no floor or ceiling effects, and that the total score of the test is an unbiased expression of the severity of the impairment. The problem then becomes to define the group of patients for which the distribution should be flat, because different distributions would be expected for acute and chronic patients. That decision depends on the purpose of the assessments. Although we found a peak around a score of 35 (see Figure 1), the rest of the distribution is rather flat, and certainly there is no evidence of either a floor or a ceiling effect. This distribution, and the fact that the mean score is close to 50, suggest that the CETI score is a meaningful and unbiased expression of communicative abilities in chronic stroke patients.

Problems using the index

Some raters seem to place their crosses over the middle of the explanations under the endpoint of the visual-analogue scale lines when they mean to give either a score of 0 or of 100. As the main aim of the index is to show change rather than absolute standing, this may not be a real problem. To avoid it, the rater should be supervised during the rating, so the true endpoints of the line can be explained, should the rater appear to have misunderstood. However, this would make the index less useful because it would require

meeting at each rating with the relative who rates (and at least two ratings are needed in order to show change).

A more serious problem is probably an artifact of our decision to use different coloured pens for each rating, in order to use the same page for all ratings rather than the several attached pages with carbon copy described by Lomas et al. (1989). It seems that most raters place crosses from succeeding ratings next to each other, rather than on top of each other when they mean to give the same score. The error introduced by this is only small, but usually seems to be systematic within the same rating. It may be averted in most cases by more detailed written instruction than those used by us. However, it is our experience that many people tend not to read, or at least not to fully understand and cooperate with, lengthy written instructions. We will, therefore, recommend that future translations and adaptions of the CETI stick to the original layout of the index papers in spite of the increased production costs.

Crockford and Lesser (1994) have claimed that relatives' CETI ratings are highly influenced by depression in the patients. This might be true—although they report on only eight patients—but it is, in fact, a quite curious argument. The very point of functional communication assessment is not to assess potential, but rather how the patient actually communicates, for whatever reason. The assessment of depressed mood in aphasia is an unresolved problem. We used our own non-verbal instrument, the Non-verbal Index of Depression (NID), and chose to report the results in spite of the lack of validation and reliability data, because no other data exist to elucidate this question. There was no association of the CETI with the NID. There were also no associations of the traditional aphasia tests with the NID. However, it could be that the NID is not sensitive to depression or that depressed patients chose not to take part in the study.

Another reservation put forward by Crockford and Lesser (1994) also seems to reflect a restricted view of functional communication: they claim that problems in the relationship between spouse and patient may greatly influence the CETI score. This seems to us to be part of a broader question that has not been raised in previous discussions of the CETI: that functional communication is, in fact, carried out between the patient and the rater, and the behaviour of both communication partners contributes to the effectiveness of the communication. A recent trend in aphasia therapy is to conduct workshops for the aphasic patients and their spouses, in order to help them discover together by what means they may improve the communication (P. Rautakosky, personal communication). The CETI would be a less useful instrument if it did not reflect improvement in functional communication resulting from such an intervention to promote a conjoint effort by the aphasic patient and the spouse.

Most certainly, all instruments for assessment of aphasia have problems, the majority of which are consequences of inevitable trade-offs. An example is the high degree of standardisation of the PICA, giving it its high reliability. It is also the cause of cooperation problems with a number of patients, and the PICA cannot be used with a substantial number of acute aphasic patients. Less inevitable, but unfortunate, design decisions also seem to be present in all aphasia tests.

CONCLUSION

Our results indicate that the CETI is as internally reliable in the Danish translation as in the original English. We found the CETI to have a lower test–retest reliability than the WAB and the PICA, but this might actually express a higher sensitivity to a real change, or there might be improvements in chronic aphasics' communication score even when the

aphasia is not improved. Our validation study suggests that the CETI is highly correlated with the traditional aphasia tests it was designed to supplement. Unique contributions by the CETI are, however, also suggested from a factor analysis yielding both a verbal and a non-verbal factor and from a much lower association with stroke severity. The CETI is not without problems. However, it is unlikely that we will ever develop a perfect instrument in any area of aphasia assessment. Trade-offs between different considerations are inevitable in aphasia assessment, and the balance of trade-offs for the CETI does not seem to imply an inordinately large proportion of problems.

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APPENDIX A

Danish translations of the CETI questions.

1. *Getting somebody's attention:*
   Opnå andres opmærksomhed.
2. *Getting involved in group conversations that are about him/her:*
   Blive involveret i gruppe-samtaler, som angår ham/hende.
3. *Giving yes and no aswers appropriately:*
   Svare ja og nej på de rigtige tidspunkter.
4. *Communicating his/her emotions:*
   Kommunikere sine følelser.
5. *Indicating that he/she understands what is being said to him/her*:
   Tilkendegive at han/hun forstår, hvad der er blevet sagt til ham/hende.
6. *Having coffee-time visits and conversations with friends and neighbours (around the bedside or at home):*
   Have besøg og samtaler med venner og naboer (omkring sengen eller hjemme)
7. *Having a one-to-one conversation with you:*
   Have en samtale på tomandshånd med dig.
8. *Saying the name of someone whose face is in front of him/her:*
   Sige navnet på en person, hvis ansigt er foran ham/hende.
9. *Commuicating physical problems such as aches and pains:*
   Kommunikere fysiske problemer som f.eks. smerter.
10. *Having a spontaneous conversation (i.e. starting the conversation and/or changing the subject):*
    Have en spontan samtale (dvs. starter samtalen eller skifter emne).
11. *Responding to or communicating anything (including yes or no) without words:*
    Svare på noget eller kommunikere noget (incl. ja eller nej) uden ord.
12. *Starting a conversation with people who are not close family:*
    Starte en samtale med personer, som ikke er nær familie.
13. *Understanding writing:*
    Forstå skrift.
14. *Being part of a conversation when it is fast and there are a number of people involved:*
    Være del af en samtale, når den er hurtig og der deltager flere personer.
15. *Participating in a conversation with strangers:*
    Deltage i en samtale med fremmede.
16. *Describing or discussing something in depth*:
    Beskrive og diskutere noget i dybden.

Explanations for the two endpoints of lines:
Not at all able: Klarer slet ikke
As able as before stroke: Klarer helt lige så godt som før

APPENDIX B

Non-verbal Index of Depression and the numbers of the associated Beck Depression Index items

1. Jeg føler mig nedtrykt og trist (I feel sad)—1
2. Jeg tænker på at begå selvmord (I have thoughts of killing myself)—9
3. Jeg græder mere end jeg plejer (I cry more now than I used to)—10
4. Jeg bliver ofte irriteret (I get easily irritated)—11
5. Jeg mangler interesse for andre (I have lost my interest in other people)—12
6. Jeg sover dårligt om natten (I don't sleep well at night)—16
7. Jeg mangler appetit (I have no appetite)—18