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A cross-cultural comparison of verbal learning and memory functions in reading disabled American and Norwegian adolescents

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The present study reports the results of a cross-cultural analysis of the role of phonetic and semantic cues in verbal learning and memory. A newly developed memory test procedure, the Bergen-Tucson Verbal Learning Test (BTVLT), expands earlier test procedures as phonetic cues are applied in addition to semantic cues in a cued recall procedure. Samples of reading disabled and typically developed adolescents from the US and from Norway were recruited as voluntary participants. The results indicate that the stimulus materials chosen for the memory test are working well in both American and in Norwegian samples, yielding acquisition results comparable to similar list learning procedures, and also yielding high internal consistency across learning trials. The procedure also reliably differentiates between reading disabled samples in both languages, and also yields cross-cultural differences that seem to reflect differences in transparency and differences in the orthography of the included languages. The BTVLT with its focus on phonetic coding is a promising supplement to established tests of verbal memory for assessment of reading and language impaired individuals.

Key words: Verbal learning, memory, semantic and phonetic features, cross-cultural comparisons.

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INTRODUCTION

Historically, the cross-cultural research design has not only theoretical value but also practical value in that data derived from one cultural group can be generalized to a different cultural group who may have similar strengths and/or weaknesses. Specifically, much cross-cultural research interest has been generated with regard to universal intellectual functions of human cognition and in the domain of memory functions. In terms of this latter domain, some research suggests that verbal memory tests are biased to many cultures, mainly because there is a lack of ecological validity when tests developed in one culture are used in another (Lim, Prang, Cysique, Pietrzak, Synder & Maruff, 2009). A. R. Luria provided a neuropsychological framework by using word-list learning for the investigation of auditory-verbal memory deficits. This methodology has been found to minimize cross-cultural test bias, and has important implications for assessing culturally and linguistically diverse individuals according to Lim *et al.*, (2009). Further, cross-cultural assessment of learning and memory performance could enrich our current knowledge in understanding auditory verbal memory deficits and how they appear in the adolescent age-period. Support for this type of research has been discussed by many cross-cultural researchers such as Berry, Poortinga, Segall and Dasen (2002), Greenfield (1997), Rosselli and Ardila (2003) and Shepard and Leatham (1999).

Although there is support for the hypothesis that memory problems in children with reading disabilities (RD) occur at the retrieval phase, other studies have suggested that verbal memory difficulties are the result of poor acquisition and storage of new information. Because recognition paradigms are believed to aid

memory retrieval, deficits on the recognition tasks were thought to be evidence of an encoding problem rather than retrieval problems (Nelson & Warrington, 1980). The reasons for poor acquisition have been explained by some research as a lack of efficient encoding strategies, most notably active rehearsal, which is believed to aid in acquiring and retaining new information in memory. Earlier, researchers like Tarver, Hallahan, Kauffman, and Ball (1976), Bauer (1977) and Cermak (1983), when examining serial position curves of students with and without RD, reported that whereas the results for students without RD revealed the common primacy-recency effect, the students with RD demonstrated a recency effect only, indicating that they were less likely to use rehearsal strategies. More recently, Kramer, Knee, and Delis (2000) found that their control group recalled significantly more words from the middle portion of the list, indicating a higher rate of active rehearsal than the children with dyslexia.

Currently, a large body of research has shown poor performance by students with RD on tasks that involve phonological processing (Catts, 1996; Fletcher, Shaywitz, Shankweiler, Katz, Liberman & Stuebing, 1994; Stanovich & Siegel, 1994; Wolf & Bowers, 1999). Such difficulties related to generating and accessing phonological representations are believed to disrupt the ability to retrieve verbal information from memory (Swanson, Zheng & Jerman, 2009). Many of these investigated the extent to which good and poor readers were able to recall similar and dissimilar sounding words. More recent studies (e.g., Desroches, Joanisse & Robertson, 2006) also demonstrated poor performance on memory rhyme tasks in children with RD, indicating that they are unable to access phonological codes. Based on such findings, it is assumed that

phonological encoding and the organizing of learning material based on phonological coding will be impaired in reading disabled individuals.

In addition to the coding of information in memory by sound, there is coding by meaning. Semantic coding has been defined as “the use of word meanings, and semantic attributes in general, to facilitate storage and retrieval of spoken and printed words from lexical memory” (Vellutino, Scanlon & Spearing, 1995, p. 77). However, the research findings exploring semantic memory coding in the RD population have been mixed. Although some studies have shown significant differences between children with RD and typical controls on memory tasks requiring the recall of semantically related/unrelated words (Dallago & Moely, 1980; Jorm, 1979; Waller, 1976, other studies have shown that children with RD can recall at the same level as control participants under certain circumstances (Ceci, 1984; Cermak, 1983; Lee & Obrzut, 1994; Swanson, 1984a, 1984b; Vellutino & Scanlon, 1985). So, even if the semantic coding may be impaired in memory in individuals with RD, the impairment is assumed to be of smaller magnitude compared to the phonology based encoding.

In summary, whereas some studies have demonstrated retrieval deficits in RD students, other studies have provided evidence for acquisition and storage problems. Alternatively, memory problems may be the result of the inability to use memory organizational skills with regard to specific linguistic components of verbal information, such as phonetic and semantic features. From a cross-cultural perspective, the Norwegian language lends itself to the study of these processes because it is referred to as a language with shallow or transparent orthography, having a close resemblance between its pronunciation and spelling, but with a more complex syllabic structure (Seymour, 2008).

Thus, the goal of the present study was to obtain insight into verbal learning and memory functions, by employing the Bergen-Tucson Verbal Learning Test (BTVLT), for the first time, on a sample of Norwegian adolescents with and without RD. This recently developed verbal learning test is modeled after the California Verbal Learning Test (CVLT) to examine verbal learning in both typical readers and disabled readers. Unlike the CVLT the authors of the current study developed culturally specific stimuli to form both English and Norwegian word lists in order to measure memory acquisition, retention, retrieval, and forgetting rates, as well as the ability to organize and retrieve the information from memory according to the phonological (surface) and semantic (lexical) features of words in both American and Norwegian samples.

Whereas the BTVLT was used previously on an American sample of adolescents with and without RD, to date it has not been used with a Norwegian sample. The data derived from the American sample suggested that students with RD had less efficient rehearsal and encoding mechanisms but typical retention. Retrieval also appeared typical except under conditions that required information to be recalled based on phonetic codes (Oyler, Obrzut & Asbjørnsen, 2012). The present study also addresses if this finding is supported in a Norwegian sample, using the Norwegian version of the test material.

METHOD

Participants

A total sample of 80 adolescent students participated in the study. The American sample of 40 students, 20 with RD and 20 without RD (non-reading disabled [NRD]), were selected from a school district in Arizona and ranged in age from 13 to 16 years. Each group consisted of 13 boys and 7 girls. The Norwegian sample also consisted of 40 adolescent students, 20 with RD and 20 NRD. Each of these groups consisted of 13- and 14 year olds (20 male and 20 female) who were recruited from schools in a rural municipality in western Norway. The two samples were equal on general abilities.

Several individual characteristics served as exclusionary criteria for participation in the study for both samples. The American sample only included students whose first language was English. Thus, students with a history of second language acquisition or bilingual services were excluded from study participation. Also, due to the verbal and attention demands of the test procedures, students who had documented speech and language disorders or attention deficit/hyperactivity disorder (ADHD) were excluded, as well as those students who had physical disabilities, sensory/motor impairments, or emotional/psychiatric disorders. The same exclusionary criteria were applied to the Norwegian sample with the exception of the second language acquisition criterion. All Norwegian students are required to be versed in both their native language as well as in English.

Test and measurements for inclusion

American sample. The students with RD had been previously identified as having learning disabilities (LD) by the homeschool district and were currently receiving special education services through an Individualized Education Plan (IEP). The Wechsler Intelligence Scale for Children-III (WISC-III) was used as a standardized measure of intelligence. Determination of special education eligibility for the students was based on a discrepancy model using a regression formula.

A skill deficit criterion was also used in the selection of students with RD to validate deficiencies in sight word identification and phonological processing. The criterion for inclusion was a standard score of 80 or lower on both the Letter-Word Identification and Word Attack subtests of the Woodcock-Johnson Tests of Achievement-Third Edition (WJ- III ACH; Woodcock, McGrew & Mather, 2001).

The NRD group consisted of average achieving students who did not evidence academic or behavioral problems. Because standardized IQ scores were not readily available for these students, the Reynolds Intellectual Screening Test (RIST; Reynolds & Kamphaus, 2003) was administered to each student. Students with RIST Composite standard scores in the average range (standard scores of 90–110) were included in this group. In addition, each student in the NRD group was administered both the Letter-Word Identification and Word Attack subtests of the WJ- III ACH. Students whose standard scores were in the average range (90–110) were included in the study. Table 1 presents the mean age, Full Scale IQ and WJ- III ACH Letter-Word Identification and Word Attack subtest scores for both the RD and NRD groups.

Norwegian sample. The Matrix Analogies Test-Short Form (MAT-SF; Naglieri, 1985) was used as a non-verbal estimate of general intellectual functioning for all participants. Both the RD and NRD groups exhibited at least average intelligence according to the MAT-SF. The Wordchains Test (WCT; Høien & Tønnesen, 1997; Jacobson, 1993) was used as a screening instrument for word recognition skills along with the Letter-chains Test (LCT) used as a perceptual control for the WCT. In addition, a 30-item single word reading (SWR) test was used as a measure of word decoding skills and a 30-item Non-Word Reading Test (NWR) was used as a test of phonological decoding skills. The reading disabled participants were identified by low scores for WCT and NWR in addition to

Table 1. Age, general abilities, and specific decoding skills for the American and the Norwegian samples

	RD		NRD	
	M	SD	M	SD
American sample				
Age	15.23	0.58	15.34	0.65
IQ ^a	97.07	5.14	100.64	4.01
Letter-Word Identification ^c	75.83*	5.88	101.72*	1.15
Word Attack ^c	69.92*	7.53	98.38*	2.33
Norwegian sample				
Age	13.87	0.95	14.07	0.73
IQ ^b	86.10*	12.17	102.85*	21.10
Single word decoding ^d	69.76**	28.38	96.03**	21.72
Nonword decoding ^d	27.58*	13.63	40.31*	16.88

Note: Abbreviations: RD = Reading Disordered; NRD: Non Reading Disordered, ^aFull Scale IQ based on assessment with WISC-III (Wechsler, 1991) or Reynolds Intellectual Screening Test (RIST; Reynolds & Kamphaus, 2003); ^bIQ estimated from the percentile score on the Matrix Analogies Test, Short Form (Naglieri, 1985); ^cWoodcock-Johnson Tests of Achievement-Third Edition (WJ-III ACH; Woodcock, McGrew & Mather, 2001); ^dWord Decoding Tasks (Asbjørnsen, Obrzut, Eikeland & Manger, 2010).

* $p < 0.05$. ** $p < 0.01$.

SWR. Table 1 presents the means and standard deviations for age, IQ and for the included variables for both the RD and NRD groups.

Materials and procedures

The BTVLT, modeled after the CVLT, is a multiple trial test designed to measure memory acquisition, retention, retrieval, forgetting rates, and the ability to organize and retrieve information from memory according to the phonological (surface) and semantic (lexical) features of words. The materials and procedures are the same as those previously used by Oyler *et al.* (2012). The test was designed for cross-cultural purposes allowing for performance comparisons between English- and Norwegian-speaking individuals. Thus, the words on the BTVLT retain the exact meaning in English and Norwegian languages. Appendix A presents the target word list (List A) and a distractor word list (List B) by trial used in the study.

This test consists of three separate word lists. The first word list, the target list (List A), comprises 16 words that are balanced with regard to both initial consonant sound and semantic content, thus allowing for either phonological or semantic clustering of items. The 16 items can be clustered into four semantic categories: body parts, utensils/tools, animals, and food. Phonetically, items can be clustered into four categories based on initial consonant sounds: c/k, f, s, and h. Appendix B presents the target list word items by semantic and phonetic groupings.

The second word list is a distractor or foil list (see List B, Appendix A) that consists of 16 new items that are related either semantically or phonetically (see Appendix C) to items on the target list. Participants were exposed to this list for one trial only.

The final list on the BTVLT consists of all of the words on the target list and the foil list, plus new words. This list is presented in a recognition format in which participants are asked to say 'Yes' if the word was on the target list or 'No' if it was not. Individual word items from the foil list and the recognition list are presented in Appendix D.

The BTVLT begins with a learning trial of the 16 words of the target list (List A) read aloud by the examiner at the rate of 1 s per word. After each list presentation, the participant is asked to free recall as many words as possible. This procedure is repeated over five trials (see Appendix A). Following this, the distractor list (List B) is presented once (Trial B), followed by a brief free-recall trial in which the participants are asked to remember words from the original list (Trial A6). This is followed by a cued-recall condition in which participants are asked to recall

words by a given category (e.g., animals) and by an initial consonant sound. After a 30-min interval, long-delay free recall (List A, Trial A1, cued recall, and recognition) is assessed. The recognition condition is a yes-no paradigm in which target words are mixed with distractor words (see Oyler *et al.*, 2012 for a full presentation of the test material).

Finally, the technical adequacy of the BTVLT was established on the English version of the instrument and is fully documented in Oyler *et al.* (2012). In sum, Cronbach's alpha was calculated as a measure of internal consistency of the BTVLT, along with Pearson product-moment correlations between the learning trials. Validity was established by correlating the BTVLT scores with the control variables of age, IQ, letter-word identification, and word attack skills because no alternative or established memory test was administered.

Cronbach's alpha for the total scale was found to be 0.87, which suggests good internal consistency of the measure. The alpha value would have been 0.90 if not for the lower score on trial one. However, this is a reflection of how Cronbach's alpha works in relation to a list learning procedure. On average, the learning trials correlated approximately 0.80 with the sum of all trials (total learning score). Pearson product-moment correlations between the trials yielded an overall significant interitem correlation of 0.59.

In terms of validity of the BTVLT, there was an increasing influence of verbal IQ (VIQ) and performance IQ (PIQ) on memory performance over trials (increasing to approximately 30% of the shared variance). In addition, the influence of IQ was very strong on phonetic cued recall (50% shared variance) but weaker for semantic cued recall (12% shared variance). Both letter-word identification and word attack skills showed similar patterns.

RESULTS

The first analysis was executed as a mixed effect ANOVA with Nationality (American; Norwegian) and Reading group (Reading Disabled; Non-disabled) as between factors, and the five learning trials as repeated measurements within subjects. The analysis yielded a main effect of Reading Groups, ($F_{(1,76)} = 25.10$, $MS\ error = 12.00$, $p < 0.001$, $\eta_p^2 = 0.248$), where the non-disabled participants showed higher overall performance compared to the reading impaired. There was also evident a significant trial effect ($F_{(4,304)} = 295.65$, $MS\ error = 1.78$, $p < 0.001$, $\eta_p^2 = 0.80$). Post hoc testing with Tukey's HSD test revealed increasing recall for all consecutive trials. Further, the two-way interactions involving Trials and Reading group and Trials and Nationality also yielded significant effects ($F_{(4,304)} = 5.48$, $MS\ error = 1.78$, $p < 0.001$, $\eta_p^2 = 0.067$) and $F_{(4,304)} = 3.78$, $MS\ error = 1.78$, $p < 0.01$, $\eta_p^2 = 0.05$) respectively. Follow up with Tukey's HSD test revealed that the between groups differences were all significant, except for Trial 1. The Norwegian sample yielded higher scores for trials 2 to 5, but not for Trial 1 (see Fig. 1.) When controlling for age as a covariate, the differences between nationality groups disappeared.

The second set of analyses concerned the delayed recall, and this was addressed in a mixed effects ANOVA similarly with Reading Group and Nationality as between groups factors, but with the factor Recall with three levels, immediate recall of the fifth learning trial, short delay free recall recorded immediately following the recall of the interference list B, and long term free recall as repeated measures within participants. The analysis yielded a main effect of Group ($F_{(1,76)} = 11.33$, $MS\ error = 15.15$, $\eta_p^2 = 0.13$, $p < 0.005$). The Recall trial also yielded a significant effect ($F_{(2,152)} = 41.18$, $MS\ error = 1.55$; $\eta_p^2 = 0.35$, $p < 0.001$). Finally the three way interaction Recall trial by

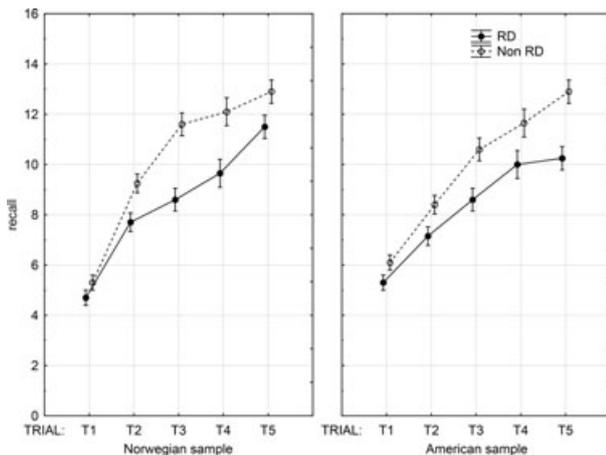


Fig. 1. Mean recall score separate for each learning trial (T1-T5) and separate for reading group (RD and Non RD) and nationality. Small bars denote +/- standard error.

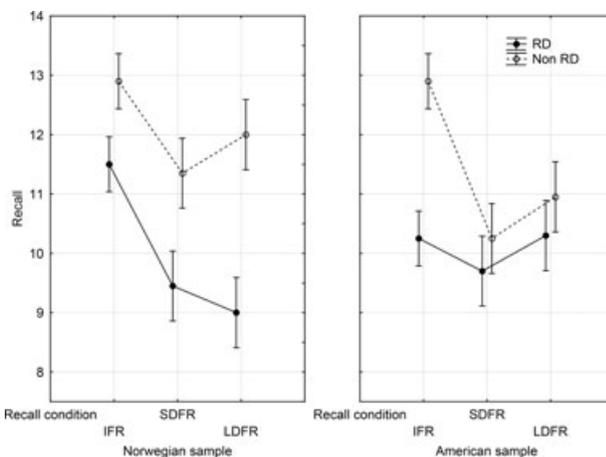


Fig. 2. Mean recall score for the three recall conditions immediate free recall (IFR), short delay free recall (SDFR) and long delay free recall (LDFR) separate for the two reading groups and nationality. Small bars denote +/- standard error.

Reading Group by Nationality was significant ($F_{(2,152)} = 11.14$, $MS_{error} = 1.55$, $\eta_p^2 = 0.13$, $p < 0.001$). Follow up on the effect with Tukey's HSD test revealed that there was a significant decrease in performance among the Norwegian non-disabled readers from T5 to short and long term delayed recall, but no difference between the two latter conditions, an effect that was not found in the American sample. The Norwegian reading disabled sample also showed a decrease from the T5 to short term delayed recall condition, but with no further change in score to the long term delay recall. The American Reading Disabled sample yielded a similar decrease in performance, but not the Non-disabled sample (see Fig. 2).

The third set of analyses focused on the utility of cued recall in the groups of participants. A four way mixed effects ANOVA with Nationality and Reading group treated as between group factors, and Cue type (Semantic vs. Phonetic cue) and Recall Delay (short delay vs. long delay) treated as repeated measures within subjects, both with two levels.

The analysis yielded a main effect of Reading group ($F_{(1,76)} = 24.57$, $MS_{error} = 5.08$, $p < 0.001$, $\eta_p^2 = 0.24$) as the Non RD

group showed higher performance compared to the RD group. Nationality also yielded a significant effect ($F_{(1,76)} = 7.92$, $MS_{error} = 5.04$, $p < 0.01$, $\eta_p^2 = 0.09$), as the American sample yielded higher performance compared to the Norwegian sample. The main effect of Recall delay was also significant ($F_{(1,76)} = 7.82$, $MS_{error} = 0.44$, $p < 0.01$, $\eta_p^2 = 0.09$), as the performance increased from short delay ($Mean = 5.13$) to the long delay ($Mean = 5.34$) test. Also the main effect of Cue type was significant ($F_{(1,76)} = 25.50$, $MS_{error} = 2.17$, $p < 0.001$, $\eta_p^2 = 0.25$). The two-way interaction of Cue type by Nationality also yielded a significant effect ($F_{(1,76)} = 4.05$, $MS_{error} = 2.17$, $p < 0.05$, $\eta_p^2 = 0.05$). Follow up with Tukey's HSD test revealed a significant decrease in performance with increasing delay of recall in the Norwegian sample but not in the American sample. Finally, the three-way interaction of Reading group by Nationality by Recall Delay also yielded a significant effect ($F_{(1,76)} = 7.68$, $MS_{error} = 2.17$, $p < 0.01$, $\eta_p^2 = 0.09$). Follow up with Tukey's HSD test revealed that the effect was due to a decrease in performance as seen in the American RD group, combined with no change in performance in the Non-RD group. For the Norwegian sample, there was no evident change in performance of the RD group, but decrease in the performance of the Non-RD group (see Fig. 3). As age did not yield significant effects on delayed recall measures, no further analyses were conducted.

DISCUSSION

In the present study we have investigated cross-cultural differences in the responses to a newly developed list-learning procedure, the Bergen-Tucson Verbal Learning Test. As the test material was developed in parallel in Norwegian and in English, with focus on equal versions of the stimulus words, translation biases were eliminated. The main finding confirmed to a large extent that this intention was achieved, as no obvious difference in performance on the acquisition trials between the Norwegian and the American sample was seen for the typically developed adolescent participants. Learning rates obtained in this study were also comparable to what is reported for similar learning tasks (e.g. Ray Auditory Verbal Learning Test, RAVLT; see Strauss, Sherman & Spreen, 2006).

There are, however, some minor differences in the performance on the tasks of delayed recall, as the decay rate, as measured by the difference between the immediate recall following Trial 5, and the short term delayed free recall, seems to be slower in the Norwegian typical readers compared to the other groups. The decay rate effect was not generalized to also include the Norwegian RD sample, as they showed a faster decay rate compared to all other groups.

In accordance with our assumption, the reading disabled samples yielded lower performance on the phonetic cued tasks compared to the typically developed participants. In earlier studies, similar effects have been found as impaired ability to recall similar and dissimilar sounding words, or impaired performance in memory rhyme tasks (e.g., Desroches *et al.*, 2006) interpreted as the result of poor access to phonological codes. Our present findings support the assumption of the impact of poor phonological encoding on the organizing of learning material based on phonological coding associated with reading disabilities.

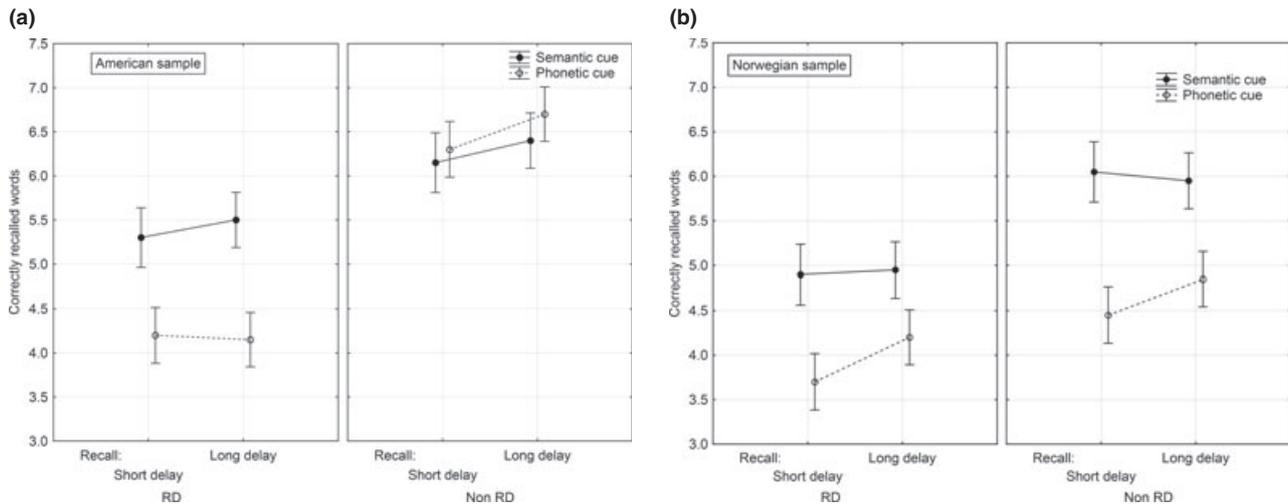


Fig. 3. Mean numbers of correctly recalled words during short and long delayed cued recall, separate for semantic and phonetic cues. The American sample is depicted in the left hand panel, and the Norwegian sample in the right hand panel, with the reading disabled groups on the left side of the figure, and the non disabled groups on the right side. Small bars in the graph denotes ± 1 SE.

In addition, the test procedure differentiated between typically developed participants and reading disabled participants according to a theory of impaired learning, as the learning curves demonstrated by the reading disabled participants reflected less efficient acquisition over learning trials. However, this conclusion is complicated by the fact that the reading impaired participants in the Norwegian sample also showed low scores for general, non-verbal abilities. As a cohort sample was used and not a clinically identified sample, this calls for further investigations.

The Norwegian language has a closer resemblance between the pronunciation and the spelling, and is referred to as a language with shallow or transparent orthography (Seymour, 2008). Phonological skills are therefore expected to be of lesser importance as a marker for reading impairments in older individuals with reading impairments compared to earlier stages in reading acquisition. We found differences in utility of the cues, as the American sample of typical readers seem to be better able to use the information in a phonetic cue compared to both the reading impaired American sample, but also to the Norwegian participants. This finding is a bit surprising, as our prediction could have been that the Norwegian language with transparent orthography would support the use of sound patterns as a scaffold for encoding. However, due to the less transparency in orthography, the deciphering of sound patterns is probably more in focus with reading in the English language, which also acts to increase the awareness of the initial phonetic cue in the American sample.

Of course, one may also speculate that the cross-cultural effects found, in particular the differences between response patterns between the reading disabled samples, could be the result of sampling bias, as the Norwegian RD sample was not screened for specific reading impairments, but constituted a low reading performance group, including some individuals with low performance on general abilities (ref. MAT-score). The impaired performance in this particular group may therefore be confounded with the influence of generalized cognitive impairments.

Furthermore, the age differences between the American and the Norwegian samples are approximately one year, together with the structure of education being different, particularly for the typical learners, such differences may implicate different strategy use in memorization as a contributor to differences in performance. This may also be supported from the less linear learning curves seen in the acquisition trials of the Norwegian sample compared to the American that could indicate a differentiation in strategy by the end of the acquisition phase.

To summarize the findings, the stimulus material chosen for the BTVLT seem to be working well in both English and in Norwegian, yielding acquisition results comparable to similar list learning procedures, while yielding high internal consistency across learning trials (Oyler *et al.*, 2012). The procedure reliably differentiates between reading disabled samples in both languages, and was found to yield cross-cultural differences that seem to reflect the variation in transparency in the orthography of the included languages. Further validation studies are called for, but the assessment of the procedure so far, suggests the BTVLT with its focus on phonetic coding, is a promising supplement to established tests of verbal memory for assessment of reading and language impaired individuals.

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APPENDIX A: TARGET WORD LIST AND DISTRACTOR WORD LIST OF THE BTFLT

Immediate Free Recall

List A		A1	A2	A3	A4	A5	List B		B	A6
English	Norwegian						English	Norwegian		
CLAW	KLO						COFFEE	KAFFE		
FROG	FROSK						FERRY	FERGE		
SOUP	SUPPE						SHOE	SKO		
HAZELNUT	HASSENØTT						HEEL	HÆL		
SCISSORS	SAKS						BOWL	BOLLE		
HAND	HÅND						DOG	HUND		
FIGS	FIKER						NOSE	NESE		
COW	KU						PENCIL	PENN		
HAMMER	HAMMER						CAKE	KAKE		
CABBAGE	KÅL						FISH	FISK		
SHEEP	SAU						SEAL	SEL		
FILE	FIL						SKIN	SKINN		
HORSE	HEST						APPLE	EPL		
FINGER	FINGER						DOLPHIN	DELFIN		
CAN	KANNE						HAIR	HÅR		
SHOULDER	SKULDER						PEPPER	PEPPER		
Sum correct										
Sum errors										

Cued recall:

Semantic cue 1

Semantic cue 2

Phonetic cue 1

Phonetic cue 2

APPENDIX B: TARGET LIST ITEMS FROM THE BTFLT

Semantic Groupings

Body Parts	Utensils	Animals	Edibles
Claw/Klo	Scissors/Saks	Frog/Frosk	Soup/Suppe
Hand/Hånd	Hammer/Hammer	Cow/Ku	Hazelnut/Hasselnøtt
Finger/Finger	File/Fil	Sheep/Sau	Figs/Fiker
Shoulder/Skulder	Kettle/Kanne	Horse/Hest	Cabbage/Kål

Initial Consonant (phonetic) Groupings

C/K	F	S	H
Claw/Klo	Frog/Frosk	Soup/Suppe	Hazelnut/Hasselnøtt
Cow/Ku	Figs/Fiker	Scissors/Saks	Hand/Hånd
Cabbage/Kål	File/Fil	Sheep/Sau	Hammer/Hammer
Can/Kanne	Finger/Finger	Shoulder/Skulder	Horse/Hest

Note: English/Norwegian version separated by slash

APPENDIX C: FOIL AND RECOGNITION TEST ITEMS FROM THE BTVLT

Foil List (Words on List B and Recognition List)

Semantic Groupings

Body Parts	Utensils	Animals	Edibles
Nose/Nese	Bowl/Bolle	Dog/Hund	Coffee/Kaffe
Hand/Hånd	Knife/Kniv	Fish/Fisk	Cake/Kake
Hair/Hår	Pliers/Tang	Dolphin/Delfin	Apple/Eple
Skin/Skinn	Pencil/Penn	Lamb/Lam	Pepper/Pepper
Heel/Hæl	Drill/Drill	Bird/Fugl	Walnut/Valnøtt

Phonetic Groupings

C/K	F	S	H
Coffee/Kaffe	Ferry/Ferge	Shoe/Sko	Heel/Hæl
Cake/Kake	Fish/Fisk	Seal/Sel	Hair/Hår
Ketchup/Ketsjup	Fog/. . .	Skin/Skinn	Hand/Hånd
Card/Kort		Sand/Sand	. . ./Hund

APPENDIX D: FOIL AND RECOGNITION TEST ITEMS FROM THE BTVLT

Probe	Yes	No	Probe	Yes	No
<u>Coffee</u>			<u>Cake</u>		
Ketchup			<u>HAMMER</u>		
<u>SOUP</u>			Sand		
<u>Heel</u>			<u>Nose</u>		
Knife			Onion		
<u>SCISSORS</u>			Melon		
Pliers			<u>Hair</u>		
Pencil			<u>SHOULDER</u>		
<u>SHEEP</u>			<u>Ferry</u>		
Lamb			Fog		
<u>Seal</u>			Whale		
<u>FILE</u>			Wheel		
<u>HORSE</u>			<u>FIGS</u>		
<u>Pepper</u>			<u>HAND</u>		
<u>FINGER</u>			<u>Bowl</u>		
Drill			<u>COW</u>		
<u>CLAW</u>			Orange		
<u>FROG</u>			<u>Fish</u>		
<u>Shoe</u>			<u>CABBAGE</u>		
<u>HAZELNUT</u>			<u>Skin</u>		
<u>Dog</u>			Apple		
Walnut			<u>CAN</u>		
Bird			Peas		
Card			<u>Dolphin</u>		
Sum			Sum		
<i>Sum total false positive</i>					
<i>Sum total correct</i>					

UPPER CASE = List ALower case = list B

False positive = number of Yes-responses to words not on List A.